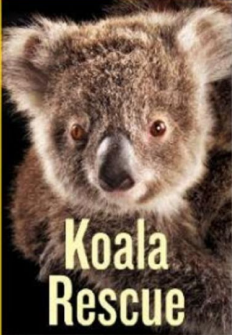


NGM.COM MAY 2012



**Koala
Rescue**

NATIONAL GEOGRAPHIC

A black and white photograph of a Civil War soldier in uniform, holding a rifle. The soldier is looking directly at the camera. In the background, an American flag is visible. The image has a slightly grainy, historical quality.

EYEWITNESS
TO THE
**CIVIL
WAR**

PLUS: The Curious World of Reenactors

FREE POSTER

{ *The March to Gettysburg* }
{ *From Slavery to Freedom* }

Volcanic Iceland

Egypt's Moment

THE DRIVE THRU LINE
THE 2nd ER VISIT
THE CARPOOL
THE ORTHODONTIST VISIT
THE VALET HANDOFF
THE DRIVE TO PRACTICE
THE DRIVE TO THE GAME
THE "WE'RE LATE, JUST CHANGE ON THE WAY" SPRINT
THE SUMMER-FRIDAY DAYTRIP
THE CUT-OUR-OWN-CHRISTMAS-TREE OUTING
THE BACHELOR-PARTY WEEKEND
THE SNOW DAY
THE CAMPING TRIP
THE DRIVE OVER INDEPENDENCE PASS
THE "WE DON'T NEED AIRLINES" SUMMER VACATION
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THE SCENIC OVERLOOK
THE "HEY, LOOK, THERE'S A MOOSE" DRIVE-BY
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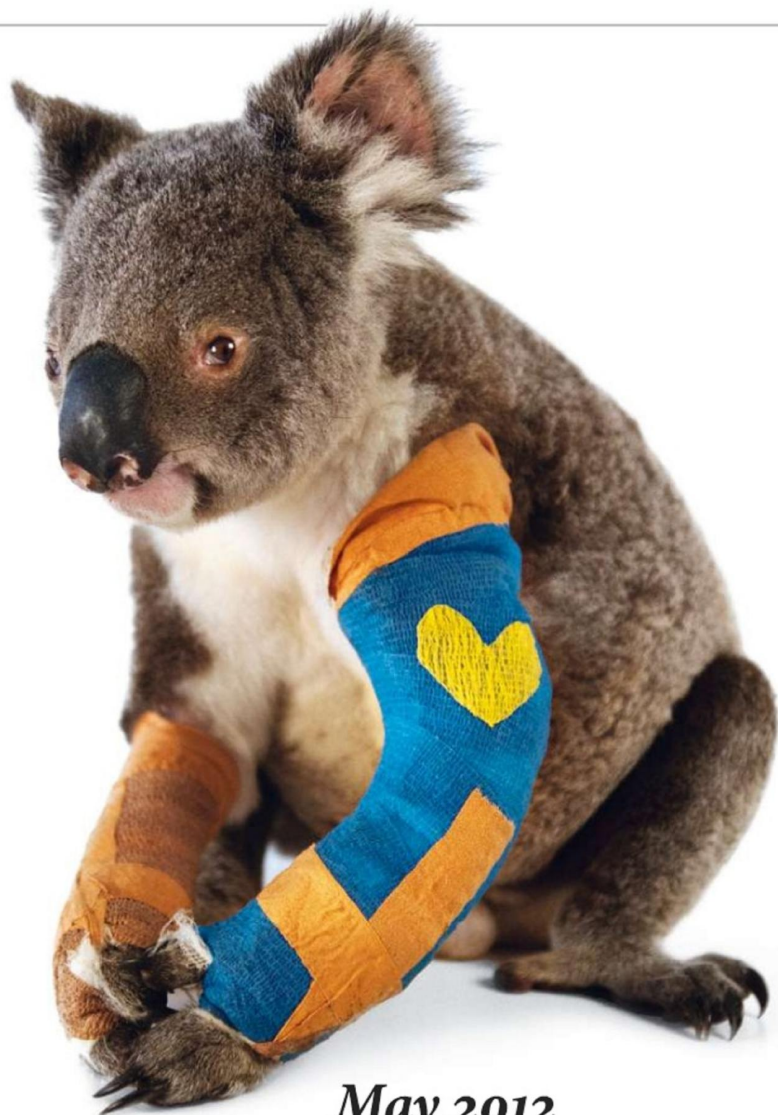
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A car hit Harley the koala. To heal his two broken limbs, the Australia Zoo Wildlife Hospital put him in colorful casts.

JOEL SARTORE

May 2012

38 Bringing the Civil War to Life

In the 1860s combat artists captured battlefield drama. Today reenactors reimagine the conflict.

By Harry Katz Photographs by Richard Barnes

**Special Poster: The March to Gettysburg/
Civil War to Civil Rights**

62 A Showboating Bird

To woo a mate, a male manakin might make music with its wings...or do the moonwalk.

By Dan Koeppel Photographs by Tim Laman

70 Egypt in the Moment

A Nile journey reveals how the revolution is playing out far from its epicenter in Tahrir Square.

By Jeffrey Barcholet Photographs by Alex Majoli

98 A Show of Hands

Humans, of course, have them. So do bats, cats, dolphins, elephants, and frogs. Our artwork takes you inside these useful appendages.

By Carl Zimmer Illustrations by Bryan Christie

106 Iceland's Resilient Beauty

Icelanders and sheep have taken a toll, but the volcanic-glacial landscape is still astonishing.

By Robert Kunzig

Photographs by Orsolya and Erlend Haarberg

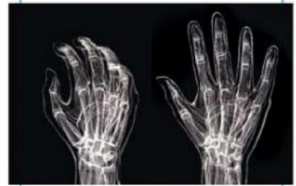
126 The Race to Rescue Koalas

Megan Aitken drives Australian streets, saving marsupials that face urban hazards and disease.

By Mark Jenkins Photographs by Joel Sartore



EXCLUSIVE ON THE IPAD



The Common Hand Animation

Song and Dance Bird Video + Interactive Graphic

The manakin moonwalks; its feathers make music.



Civil War Video + Interactive Map

Travel to Gettysburg. Explore a time line.



PHOTO: BRYAN CHRISTIE (HANDS)

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Nails on a Blackboard

Skree-ee-ee-eechchch! Let us tell you why people hate that sound.

Risky Park Business ▶

Which national parks see the most accidental deaths—and why?

Birth of Brinicles

The briny ice tubes start at the sea's surface and sometimes hit its floor.



33 NEXT

Venus Crosses the Sun ▶

It'll happen in June. And it won't happen again until 2117.

A Who's Who of Space

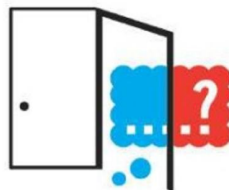
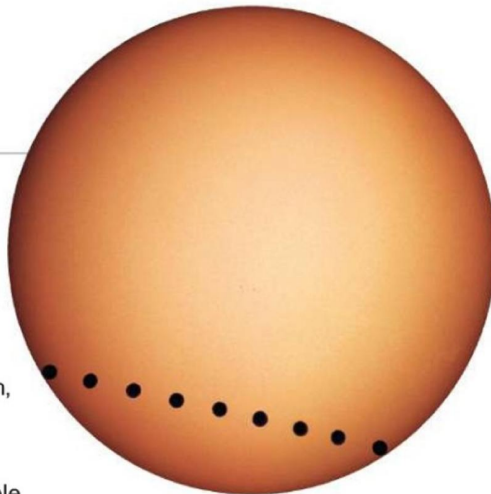
The roster of travelers includes many men, relatively few women, one clown.

Miner Lifeline

A new wireless system will enable trapped miners to talk to rescuers.

Doorway to Forgetting ▶

Um, why did I walk from the kitchen to the den? Science now has an explanation for your forgetfulness.



On the Cover

Portraits produced on glass, like this one of a Union soldier, were sent to loved ones during the Civil War.

Photo by Rebecca Hale, NGM Staff; Liljenquist Family Collection, Library of Congress Prints and Photographs Division

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Special Artists

The action at the Battle of Munfordville in 1862 was so fast and furious it could not be captured by the slow, bulky cameras of the day. But Henri Lovie could and did capture that Kentucky conflict with pencil and sketchbook. Lovie was one of the “special artists,” illustrators embedded with both Union and Confederate forces during the Civil War.

This month we share the seldom seen sketches of Lovie and his brave colleagues. Their work and the stories behind their art have become a passion for Harry Katz, author of our piece. Katz has spent years locating their sketches and bringing their experiences to light. “Specials were trying to portray the war as publishers wanted, the generals demanded, and the public expected, but it wasn’t working out that way,” he says. “War and death were meant to be portrayed with dignity and respect. But this scene blasts convention off the page with explosive graphic power.”

Katz discovered what it took to be a special artist in a quote from Theodore Davis, who covered the entire war: “Total disregard for personal safety and comfort; an owl-like propensity to sit up all night and a hawk style of vigilance during the day; capacity for going on short food; willingness to ride any number of miles horseback for just one sketch, which might have to be finished at night by no better light than that of a fire.” The men who made these sketches had a mission. Like the war correspondents who followed them into the field in decades to come, they witnessed and recorded a terrible conflict for all to see.

The men who made these sketches had a mission.



Henri Lovie sketched this scene of Rebel troops at the Battle of Munfordville in 1862.



Darwin's Frog (*Rhinoderma darwini*)

Size: Head and body length, 22 - 31 mm (0.9 - 1.2 inches) **Weight:** Unknown **Habitat:** The leaf litter of temperate forest on the cool, wet banks of streams **Surviving number:** Unknown; populations declining



Photographed by Michael and Patricia Fogden

WILDLIFE AS CANON SEES IT

Mr. Mom. The male Darwin's frog goes to extraordinary lengths to nurture his growing young. After the female lays eggs in leaf litter, he fertilizes them and patiently remains nearby for about 20 days. He then picks up the tadpoles or embryos about to hatch and maneuvers them into his vocal sac, where they continue to develop. After some 50 to 70 days, juvenile frogs emerge from the male's mouth. This unusual amphibian,

first collected by Charles Darwin during his famous voyage, has the ability to "play dead" when threatened. But the fatal forces of habitat loss and disease that afflict it today are all too real.

As we see it, we can help make the world a better place. Raising awareness of endangered species is just one of the ways we at Canon are taking action—for the good of the planet we call home. Visit canon.com/environment to learn more.



Land Mines

As an undergraduate, I spent time working at the Stanford University map library. For a map lover there were thousands to see and enjoy. One day a researcher pulled out a map I had never seen—a white sheet, its network of black roads and place-names covered in thousands of little red dots, many in large clumps, covering towns and regions. He explained that it was a map of land mines in part of Cambodia. I was struck, and that map has remained in my mind as the most powerful and heartbreaking I've seen. I'm so glad to hear that this map looks different today.

TWILA MOON
Big Sky, Montana

I lived through World War II in Italy as a child. At the end of the war, I was told in no uncertain terms that I was not to go walking in an open field that had not been recently trampled upon. This idea was so inculcated in my head that when I moved to southern California to start work as an engineer at Caltech's Jet Propulsion Laboratory in September 1962, I still could not walk in an untrampled field without having an uneasy

feeling. This despite my having a graduate degree in mathematics (a most rational discipline) and it being a good 17 years after the end of World War II.

EZIO PIAGGI
Pacific Palisades, California

We Americans take for granted being able to walk on country roads and lanes, but Cambodians—and people in other Southeast Asian countries—are deprived of that simple pleasure. I hope better ways

are discovered to locate land mines that destroy limbs and lives. Those weapons of past wars make peacetime hellish.

HOSEA L. MARTIN
Chicago, Illinois

Twins

I'm quite sure I am the minority vote, but while I love my brother and am closer to him than any other person except for my wife, I despise being a twin. I consider it the most unfortunate aspect of my life. In the common public perception I am not considered a unique individual, but merely half of a whole—as the second born, the lesser half. I thank you for helping to dispel this myth.

BRUCE WHITE
Wichita, Kansas

I'm an identical twin. Genetically, my brother's children and my children are not cousins, but half brothers and sisters. Had their mothers been identical twins, they would be true brothers and sisters.

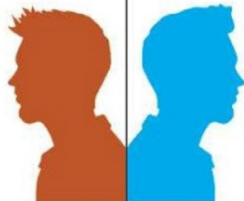
GORDON D. ROWE
Millersville, Pennsylvania

FEEDBACK *Twin readers and their parents took sides on the alike/not alike issue, strongly supporting both theories.*

Twins experience "sympathetic pain and extrasensory perception. We were, after all, 'womb mates.'"

"My brother is somewhat my 'Picture of Dorian Gray' in that he generally gets the ailment first."

"When one calls home, I can expect the other one to be calling within minutes."



"Of our 'identical' sons, one is so extroverted and outgoing, while the other is so introverted and reserved."

"My sister and I find it desperately hard to keep a civil tone and tolerate each other."

"He is scientific, while I am artistic. I am gay and he is not."



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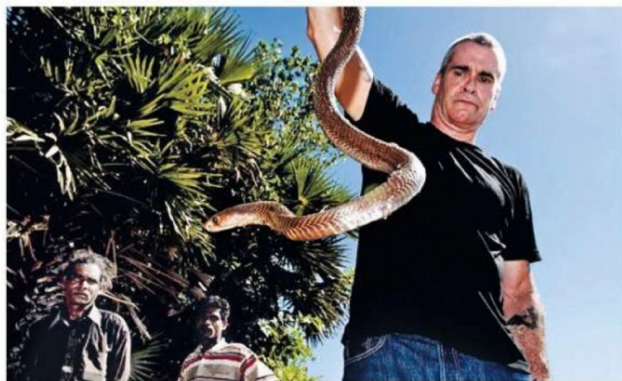
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THIS MONTH

Extreme Civil War Reenactors

For some Civil War buffs, it's not a hobby—it's a calling. Folks like these will go from Fort Sumter to Gettysburg to reenact battles in honor of the war's 150th anniversary.



Henry Rollins holds a spectacled cobra in Chennai, India, while members of the Irula tribe stand by.

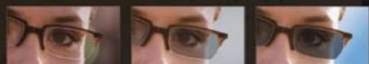
ANIMAL UNDERWORLD Some activities are not for the faint of heart. But performer Henry Rollins can handle just about any situation on his quest to understand the ways humans and animals interact. Rollins crosses the globe—witnessing cow reverence in India and roadkill eating in North Carolina—to find answers to confounding questions. Why willingly invite crocodiles into your home? Or choose to smoke potentially toxic toad venom? Watch him test the boundaries between safe and deadly, coddling and cruel in this new, three-part series.

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VISIONS

A man wearing a white jacket, a white cap, and brown pants is standing on a sandy beach. He is holding a slingshot in his right hand, aiming it towards the horizon. The background shows a clear blue sky, a sandy beach, and a small thatched umbrella in the distance. The word "VISIONS" is written in large white letters in the top left corner, with a yellow horizontal bar underneath it.



Morocco

Practice makes perfect, even for dogs. With a single bound, this one clears the entire gap in a beach wall in the coastal town of Essaouira. Takeoff was preceded by a running start, as well as several practice jumps.

PHOTO: ALVARO SANCHEZ-MONTANES



United States

A dead athel tree, bathed in moonlight in a long night exposure, attests to the former fertility of what is now a salt pan at the Salton Sea's edge. Salinity in the California lake, 231 feet below sea level, is some 50 percent greater than in the Pacific Ocean.

PHOTO: JIM LO SCALZO





United States

On Massachusetts's Plum Island a piping plover plumps for one of its main roles following the hatching of its chicks: warm cover. Though able to feed on their own within a few hours, the chicks need help maintaining their body temperature.

PHOTO: MICHAEL MILICIA

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EDITORS' CHOICE **Charley Elmaga** Riyadh, Saudi Arabia

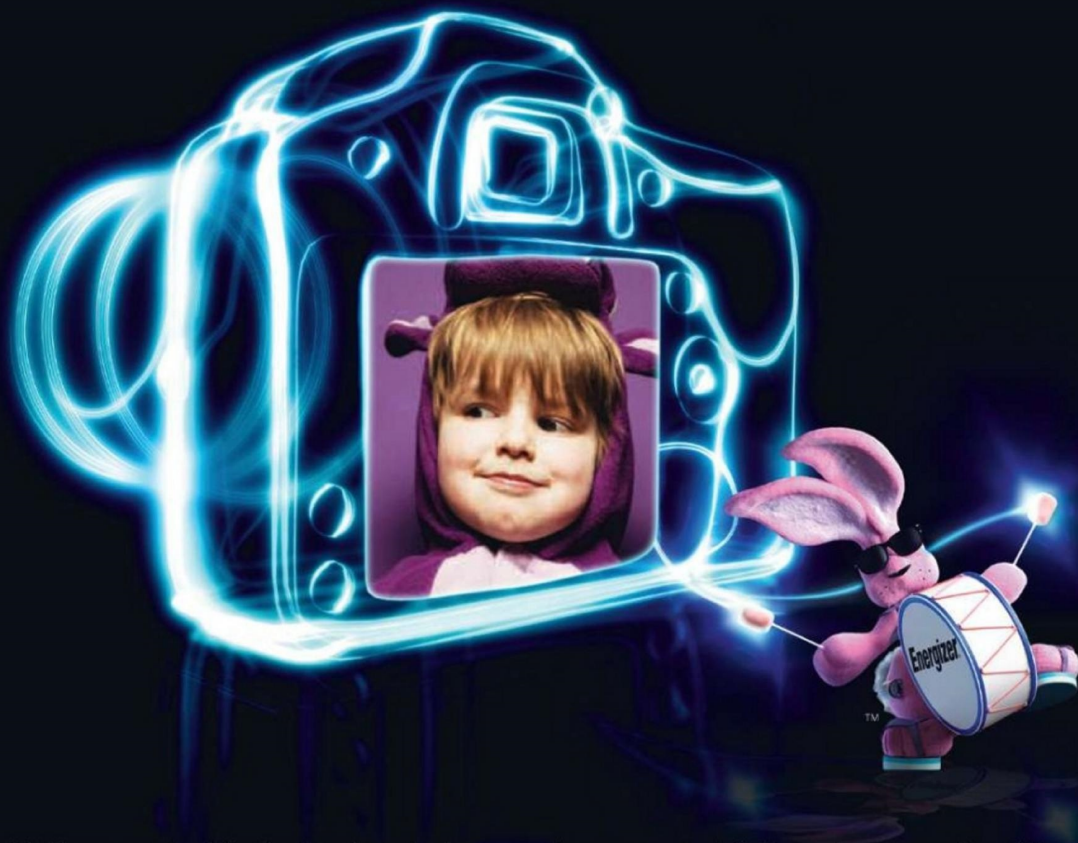
"Please forgive me, my darling." That's what Elmaga envisions the kneeling matchstick man (at right) saying to his lady, perched atop matchboxes. Inspired by photography lessons, the 42-year-old Elmaga, a secretary, spent two hours getting this shot.



READERS' CHOICE **Sarah Jones** Durban, South Africa

Surf photography is Jones's hobby, and these wave riders were a real catch. "Often the dolphins leap out of the wave back to the sea—a beautiful sight," says the retired nurse, who lives nearby.

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"The Vegetable Gardener"
by Arcimboldo, circa 1590

Seen as I intended, the hat holds my signature. But even upside down, the image still works as a bowl of vegetables.

THE PHOTOGRAPHER

Klaus Enrique is based in Mexico City and London. More of his work can be seen at klausenrique.com.

Arcimboldo Again When I first encountered painter Giuseppe Arcimboldo's work, I was deflated. There was no point in carrying out the "new" concept I had for a portrait series—it had been done 400 years ago, and done magnificently. But my research has shown me it wasn't even his idea. These portraits date from the first guy to grab two stones and a stick and say, Hey look, a face.

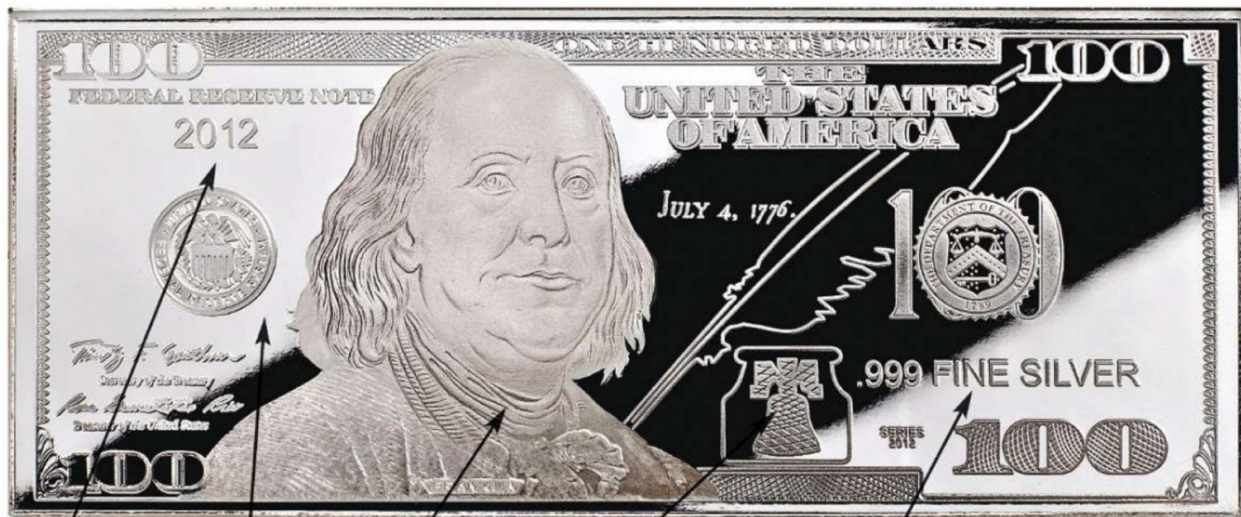
Today I don't mind getting an email saying, You are a thief; you are scum—like I went to the Louvre

and just wrote my name on top of all the Arcimboldos. I think photography is the right medium for this. It is more powerful to see the real things; they bring a rawness that painting could never do.

To think Arcimboldo, or anyone else, has the last word is a farce. My photographs are just a part of the body of work as well. I can imagine a day in the future when some artist will use genetic engineering to create a living plant that looks exactly like Arcimboldo's "Vertumnus." It will be arresting.

Limited Mintage Striking...

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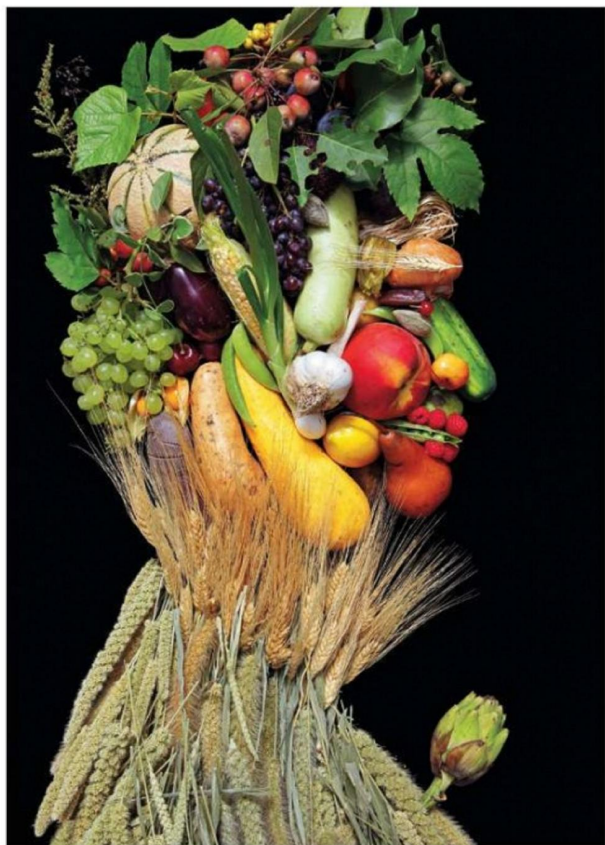
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“Summer” painted 1563

The more I do, the freer I feel to deviate, as I’ve done here. Like a tree branch from the trunk, sometimes it goes a little to the left, other times it goes up. I’ve even started creating “Arcimboldesques,” including one of Princess Diana.



“Winter” painted 1572

Finding the right piece of bark seemed futile; I searched many woods without results. In the end I gave in and ordered cork bark. The first piece out of the box looked just like what I had been searching for—for so many weeks.



“Spring” painted 1573

Some people say, “This is really pretty; it’s made with flowers.” But the nature of these images is fractured. It’s trickery. I recruited the help of a florist friend of mine, Julian Calderon, and it took us more than three days of nonstop work.



PHOTOS: GALLERY COLLECTION/CORBIS ("SUMMER"); UNIVERSAL HISTORY ARCHIVE/GETTY IMAGES ("WINTER"); VITTORIO ZUNINO CELOTTO, GETTY IMAGES ("SPRING")



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Shrill Science

In a ranking of worst sounds, nails on a chalkboard rated first, outpacing scraping forks and Styrofoam squeaks. Why is it so awful?

The ear canal is a long tube, wide open at the ear and closed at the drum. Studies show sounds from 2,000 to 4,000 hertz are highly amplified once inside, likely because parts of the human voice fall in that range—perhaps all the better to distinguish among vowels and consonants, says sound researcher Michael Oehler. But when the tube collects the parts of that shrill scrape also in the range, it can mean piercing reverb—and a physical reaction. Even imagining the sound may cause perspiration and increased heart rate, says Oehler of his next phase of research, which he hopes might spur vacuum cleaner and machinery makers to sweeten everyday sounds. —*Johnna Rizzo*

When Parks Turn Fatal

Summertime beckons tourists to America's national parks. Though most of the estimated 275 million visitors emerge each year with nothing more than fond memories, a small percentage face injury and even death.

Last year two fatal bear attacks in Yellowstone and the loss of three tourists swept over a Yosemite waterfall captured headlines. While extremely rare, they speak powerfully to the kinds of tragedies that can befall even the most prepared nature enthusiast. Still, lack of awareness and preventable missteps lead to numerous accidents. Search and rescue efforts cost the National Park Service around five million dollars a year.

"The most common mistake is not realizing the hazards are real and unforgiving," says Ken Phillips, emergency services chief at the Grand Canyon, which deploys rangers to talk safety. So plan ahead, set realistic goals, heed warnings, pay attention—and enjoy the view. —Luna Shyr



OVER 250 PEOPLE ARE RESCUED FROM THE DEPTHS OF GRAND CANYON EACH YEAR...

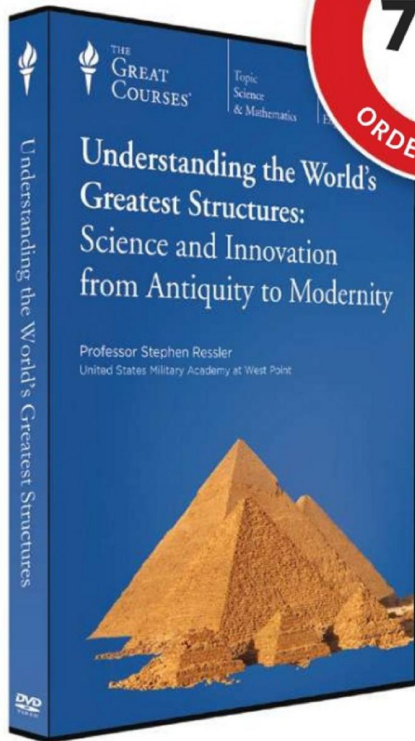
Most of them look like him.

- stay hydrated (drink plenty of water and electrolyte drinks)
- eat often (carbohydrates & salty foods)
- avoid hiking in the heat of the day (10am to 4pm)
- rest often (sit in the shade)
- get wet (wet your shirt, hat, & wear a wet bandana around your neck)
- DO NOT attempt to hike down to the river and back in one day

GRAND CANYON HIKE SMART

NATIONAL PARK SERVICE U.S. DEPARTMENT OF THE INTERIOR Grand Canyon National Park

Signs like this, part of Grand Canyon's Hike Smart program, alert hikers to potential dangers. Heat is the primary cause of accidental deaths at the Arizona park.



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ICE STALACTITES

In the frigid waters of Antarctica, briny tubes of ice can stretch down to the seafloor.

ODDITIES ABOUND AT THE WORLD'S POLES. Now, thanks to time-lapse cameras, we can see one coming to life. This salty ice stalactite, aka a brinicle, was filmed as it formed last year by British cameramen Doug Anderson and Hugh Miller in Antarctica's McMurdo Sound.

Ice stalactites were first described in detail in 1971 by American oceanographers Paul Dayton and Seelye Martin. According to Martin, who grew them in his Seattle laboratory, the phenomenon occurs naturally in polar winters, when air temperatures can dip well below 0°F while the water may be a relatively balmy 28°F.

That differential is key. Warm seawater flows upward into sea ice on the surface that's veined by a network of channels. As the water cools, dense brine—too saline to become part of the ice pack—drains out and sinks back into the ocean. As it descends, it freezes the water around it in a plume that grows about a foot an hour. If conditions are right, a brinicle can reach the seabed. There it creeps along, pooling at low points.

In the 1970s, Martin recalls with a laugh, “the Navy asked if they're dangerous to submarines.” They're not. In fact, they're too slow forming to freeze anything but bottom dwellers like sea stars. And they're fragile enough to be broken apart by seals or currents. When that occurs, or when the brine stops seeping, a brinicle “dies.” But it may get a second life. Anderson saw fish making homes of dead brinicles covered in platelet ice, structures resembling “very beautiful chandeliers”—another polar curiosity. —Jeremy Berlin

PHOTO: FROZEN PLANET, BBC/DISCOVERY



A "brinicle" descends about seven feet from the surface ice near Antarctica's Little Razorback Island. After reaching the seabed, the brine formed a stream that froze sea stars and sea urchins.

Inspire Future Generations



Grace Cleere included National Geographic in her estate plans.

A communications expert for the government, Grace Cleere recently named National Geographic as a beneficiary in her will. “I included a bequest intention to National Geographic because I believe in everything the organization represents,” says Cleere. “If we don’t understand our world, we are bound to mistreat it. And if we are not curious about all living things on our planet, we are bound to lose them through thoughtlessness and indifference. National Geographic shines a spotlight on the critical issues of the day and proposes innovative solutions that are grounded in science. I feel good about my legacy knowing that National Geographic will leverage my gift so it can have the greatest impact.”

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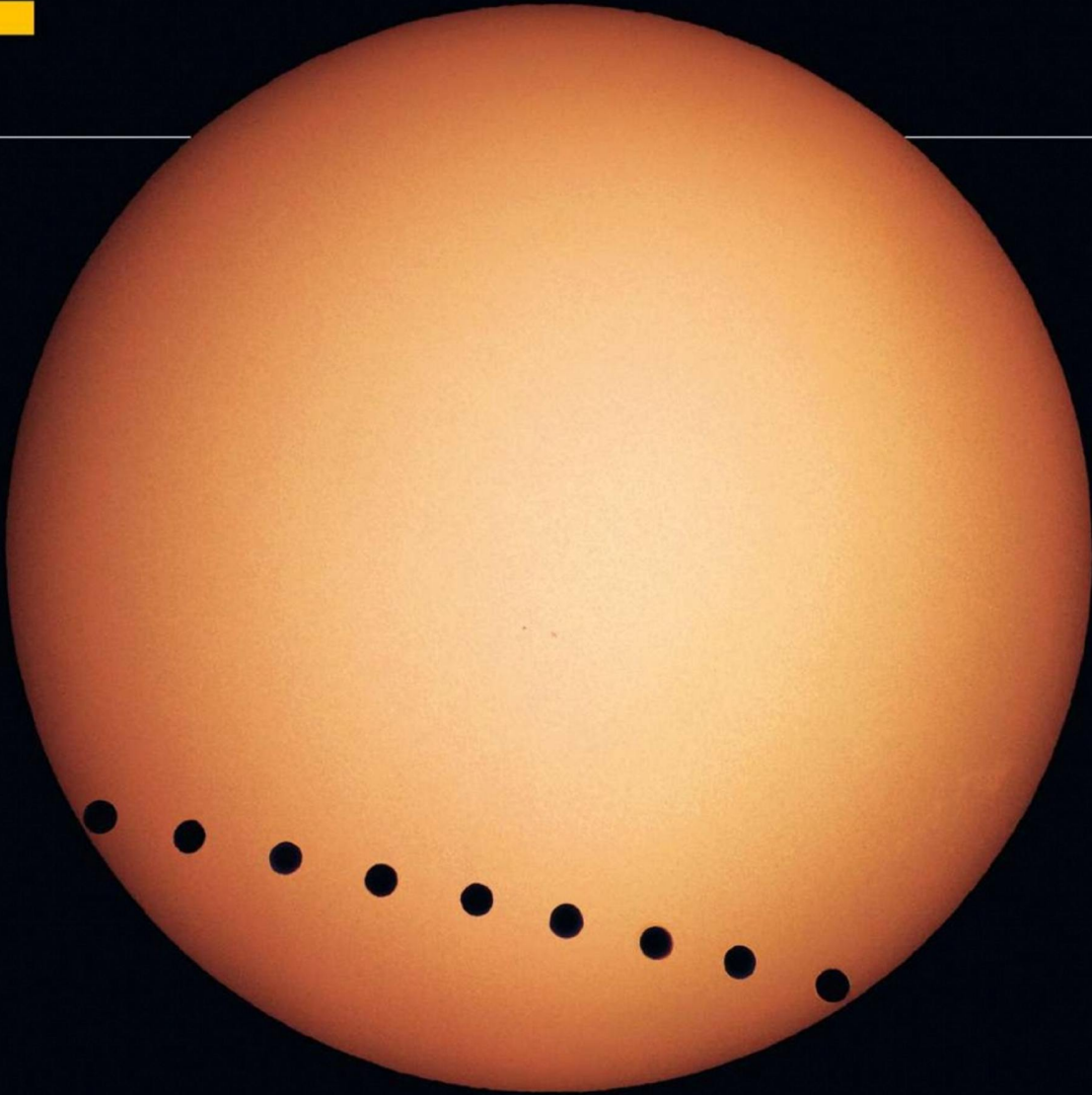
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NEXT



Venus: Rite of Passage

In 1716 Edmond Halley, of comet fame, inspired one of the great scientific challenges of the 18th and 19th centuries. He described a technique for calculating Earth's distance from the sun using observations of Venus passing across the solar face. Nations like Great Britain and France responded with far-flung expeditions—including one by Captain James Cook—to study the transit of Venus, one of the rarest astronomical phenomena visible from Earth.

Today other methods are used to measure interplanetary distances. But Venus still draws "transit chasers." On June 5 and 6 the second of an eight-year transit pair will appear over North America, Asia, Oceania, and most of Europe. It's the last time Venus will align with the Earth and sun until 2117. Because of differences in the planets' orbits, just 18 transits grace the sky this millennium. —Luna Shyr



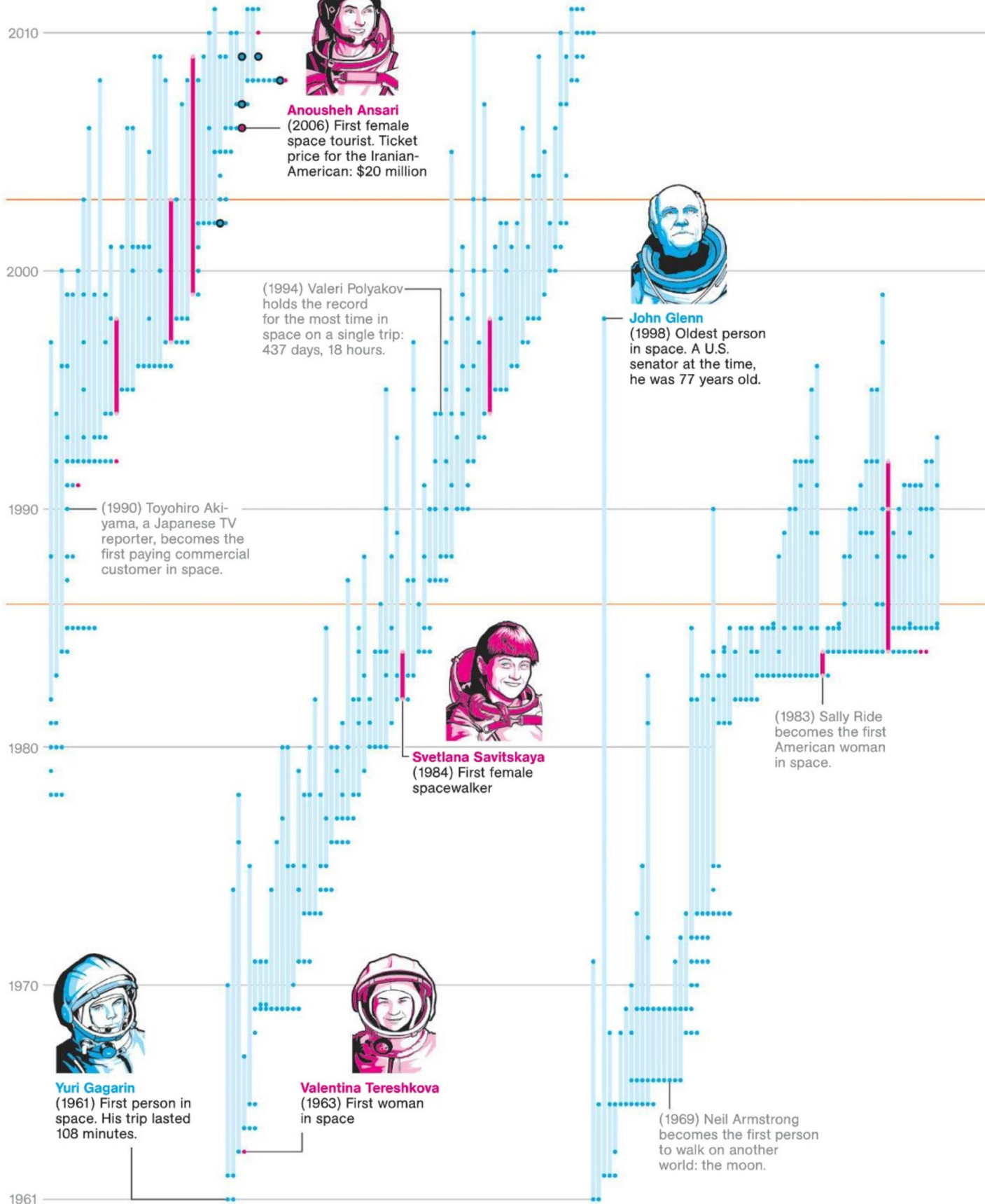
Sky-watchers can see Venus cross the sun (top) when both are aligned with Earth—a rare event because Venus's orbit is faster and tilted relative to Earth's.

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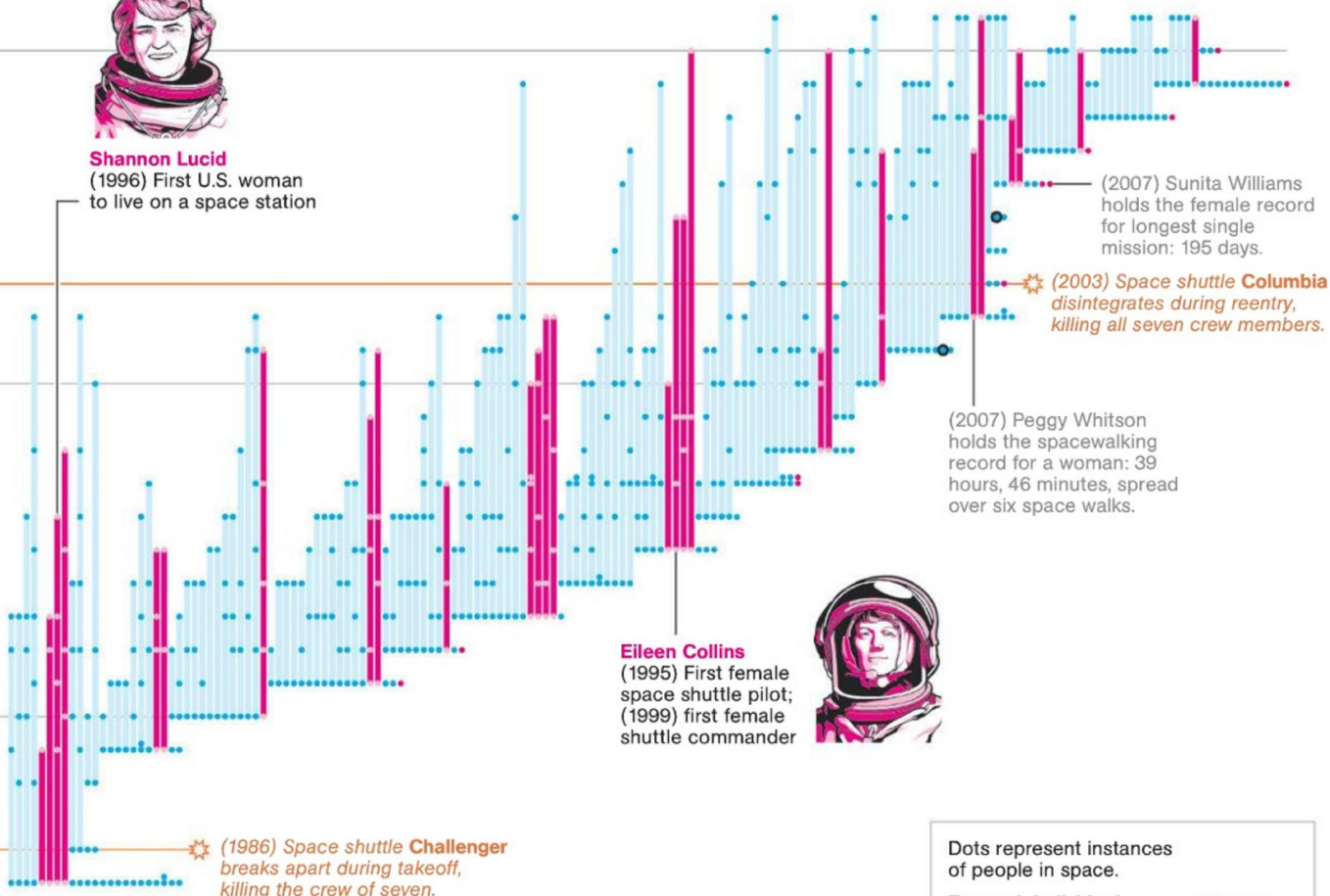
SOVIET/ RUSSIAN

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Shannon Lucid
(1996) First U.S. woman to live on a space station



★ (1986) Space shuttle **Challenger** breaks apart during takeoff, killing the crew of seven.

Eileen Collins
(1995) First female space shuttle pilot; (1999) first female shuttle commander



(2007) Sunita Williams holds the female record for longest single mission: 195 days.

★ (2003) Space shuttle **Columbia** disintegrates during reentry, killing all seven crew members.

(2007) Peggy Whitson holds the spacewalking record for a woman: 39 hours, 46 minutes, spread over six space walks.

Dots represent instances of people in space.

For each individual:

- Male
- Single-mission career
- OR
- Multiple-mission career
- Tourist

Who's Been to Space?

If not for Dwight D. Eisenhower, sailors and mountain climbers might have been among the first Americans lofted into space. That's because NASA initially considered asking a variety of people with high-risk occupations to apply for the astronaut corps. But the U.S. President made the call: Astronauts had to be military test pilots, who in 1959 were all men.

The doctor who designed the astronaut screening exams wondered how women would fare. "The thinking was, the Mercury capsule is small, so why not have smaller people inside?" says NASA historian Bill Barry. Thirteen women passed unofficial, privately funded tests in the early 1960s. Nearly two decades later NASA accepted its first female astronauts. After 2000 civilians started undergoing training to fly as space tourists—including a circus clown, Cirque du Soleil founder Guy Laliberté. Now, as eyes turn toward Mars, experts are asking how humans will weather interplanetary treks. Among the issues: radiation exposure, bone loss, and faster aging. —Victoria Jaggard



1963 Valentina Tereshkova's three-day trip set the first milestone for women in space. Others are highlighted in the time line.

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The Beauty in the Beast

For almost a hundred years it lay dormant. Silently building strength. At 10,000 feet high, it was truly a sleeping giant, a vision of peaceful power. Until everything changed in one cataclysmic moment. On May 18, 1980, the once-slumbering beast awoke with violent force and revealed its greatest secret.

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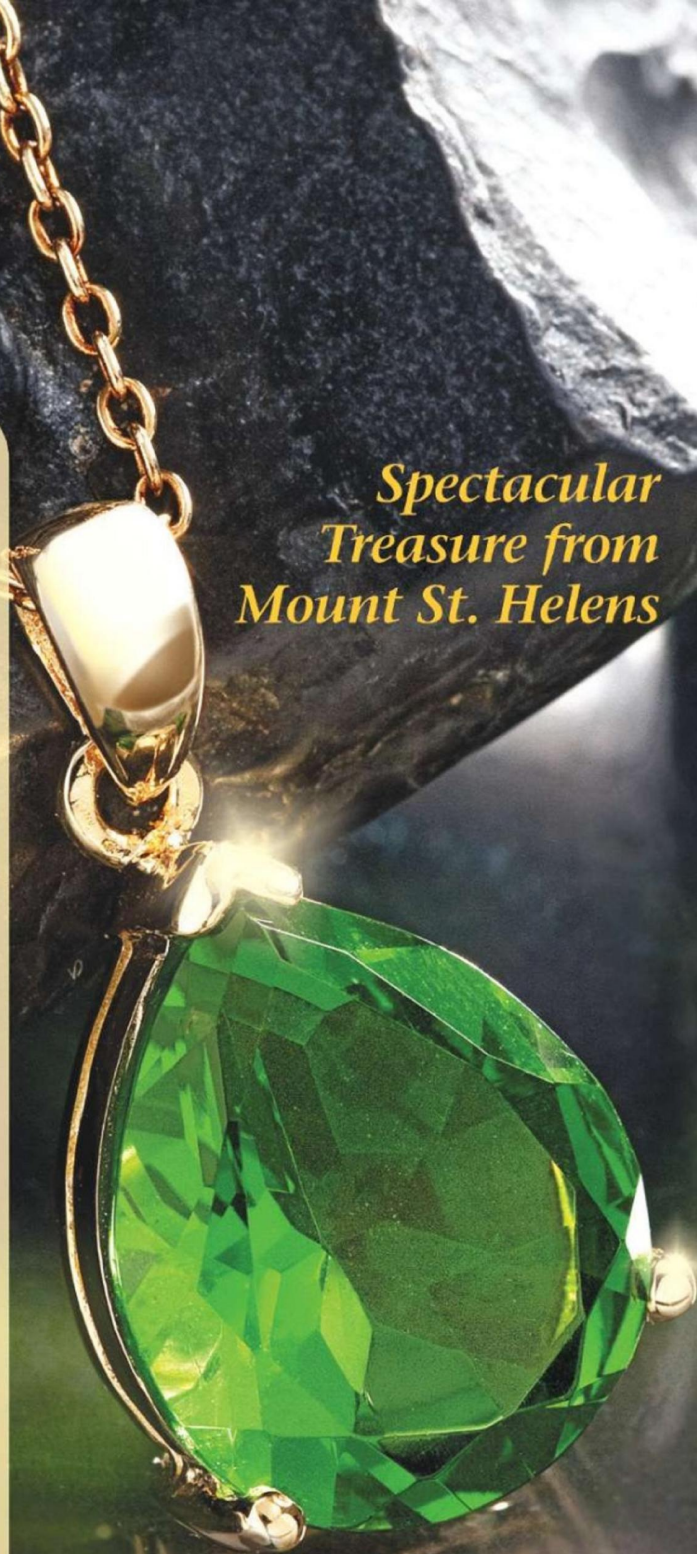
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An explosion-proof transceiver can conduct messages from a trapped miner by magnetic field.

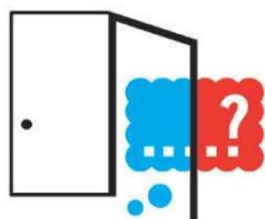


Miner Lifeline At West Virginia's Robinsom Run—a knot of tunnels bigger than Manhattan—600 miners brought up nearly six million tons of coal last year. Now the mine is testing a wireless system to keep miners connected during collection.

Since radio waves can't penetrate the earth, miners going underground are trained to pound the roof with a wooden post to send seismic messages if trapped; at the surface, rescuers use explosives to create a vibration signal that they're looking. This new link uses magnetic energy, which can cut through rock, coal, and metal—letting trapped miners and rescue teams actually talk through the earth. Voice or text can move more than 1,500 feet up or down and 2,000 feet laterally, arriving in less than a minute. "I hate to even think it, but if for some reason I couldn't get out, I could communicate," says safety director Todd Moore. —*Johnna Rizzo*

How It Works

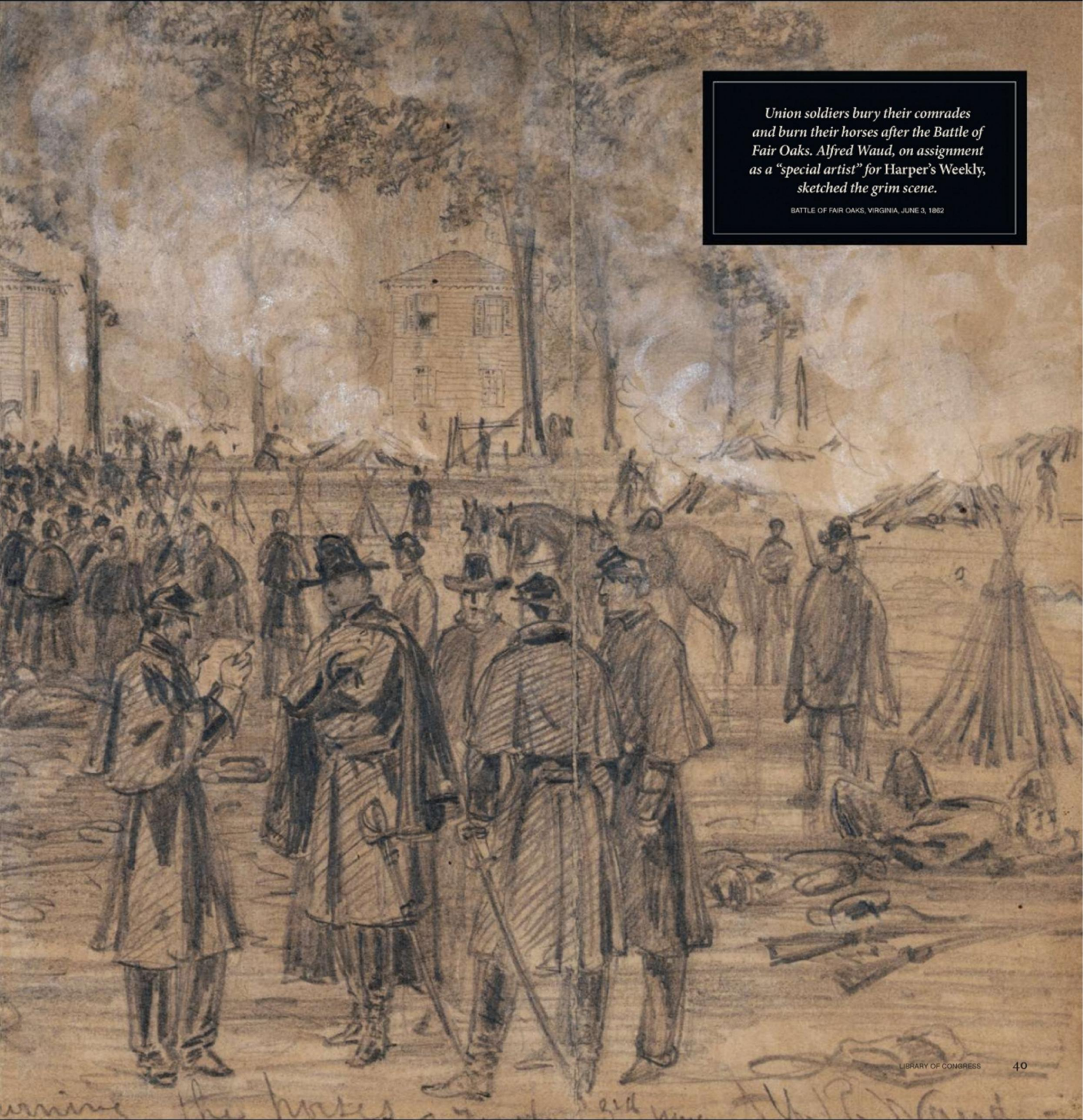
- 1 Voice, text, or SOS beacon gets wrapped in magnetic waves.
- 2 The now magnetic message moves through the earth.
- 3 Magnetic bubble pops when receiver recognizes source.



DOOR TO AMNESIA A bedroom lightbulb burns out. New bulbs are in the kitchen. Off you go, but when you arrive you think, Why am I here? That brain blip may not be mere absent-mindedness. Gabe Radvansky, a psychology professor at Notre Dame, had study participants carry objects around a house. "They couldn't remember objects as well when they crossed through a doorway," he says. Conclusion: Change of venue makes the brain "push old stuff out and focus on what's going on now," a good strategy for cavemen heading from forest to field. Modern solution: Take a Post-it (or burned-out bulb) with you. —*Marc Silver*



Four cooks enter the battle, burning the dead - and I



Union soldiers bury their comrades and burn their horses after the Battle of Fair Oaks. Alfred Waud, on assignment as a "special artist" for Harper's Weekly, sketched the grim scene.

BATTLE OF FAIR OAKS, VIRGINIA, JUNE 3, 1862

A
SKETCH
IN
TIME

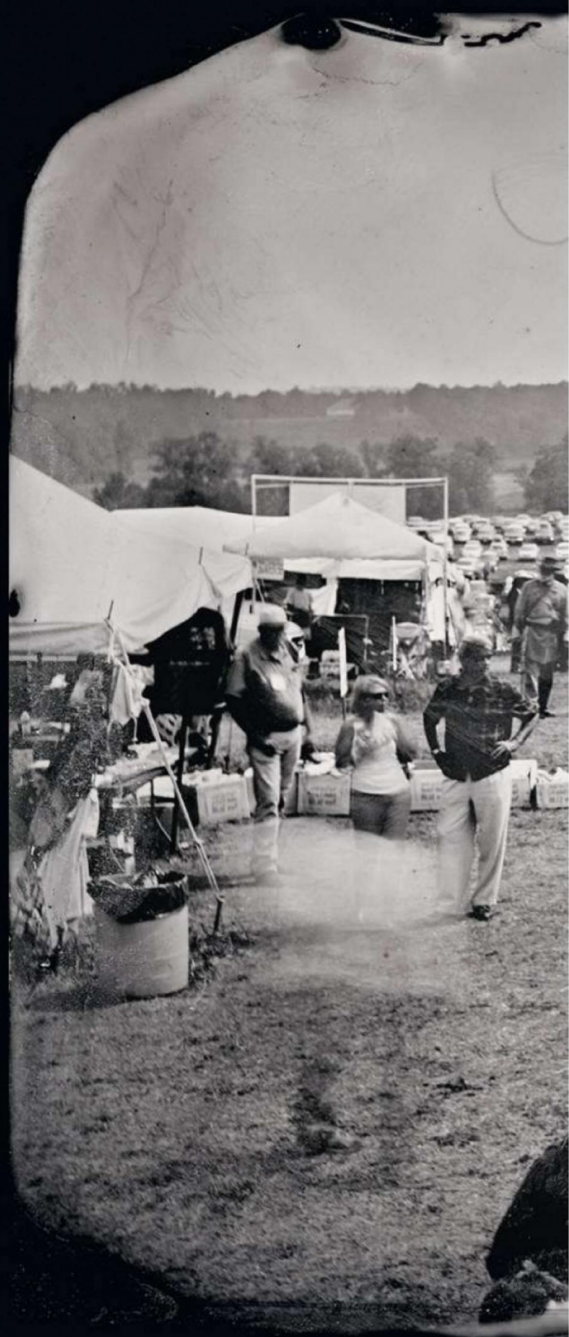
BRINGING THE CIVIL WAR TO LIFE

PART ONE

The world came to understand the Civil War through the eyes of battlefield artists. Living alongside the troops, combat illustrators risked death, injury, and disease to convey the blow-by-blow of battle with pencil and pen, charcoal, and crayon. Their work, sketched in the direst of circumstances, shows terrible violence but also moments of surprising grace.

PART TWO

Every year thousands of Americans keep the memory alive by reenacting Civil War campaigns and battles. Photographer Richard Barnes used period techniques to make authentic-looking images that include glimpses of the modern world.





A scene of vendors at a July 2011 reenactment of the 1863 Battle of Gettysburg, Pennsylvania, appears historical when photographed on a wet plate coated with chemicals.

RICHARD BARNES

CIVIL WAR BATTLEFIELD ART

“They have shared the soldier’s fare; they have ridden and waded, and climbed and floundered, always trusting in lead pencils and keeping their paper dry... The fierce shock, the heaving tumult, the smoky sway of battle from side to side, the line, the assault, the victory—they were a part of all, and their faithful fingers, depicting the scene, have made us a part also.” —Harper’s Weekly, June 3, 1865

BY HARRY KATZ

AT THE TIME OF THE CIVIL WAR, camera shutters were too slow to record movement sharply. Celebrated photographers such as Mathew Brady and Timothy O’Sullivan, encumbered by large glass negatives and bulky horse-drawn processing wagons, could neither maneuver the rough terrain nor record images in the midst of battle. So newspaper publishers hired amateur and professional illustrators to sketch the action for readers at home and abroad. Embedded with troops on both sides of the conflict, these “special artists,” or “specials,” were America’s first pictorial war correspondents. They were young men (none were women) from diverse backgrounds—soldiers, engineers, lithographers and engravers, fine artists, and a few veteran illustrators—seeking income, experience, and adventure.

It was a cruel adventure. One special, James R. O’Neill, was killed while being held prisoner by

Quantrill’s Raiders, a band of Rebel guerrillas. Two other specials, C. E. F. Hillen and Theodore Davis, were wounded. Frank Vizetelly was nearly killed at Fredericksburg, Virginia, in December 1862, when a “South Carolinian had a portion of his head carried away, within four yards of myself, by a shell.” Alfred Waud, while documenting the exploits of the Union Army in the summer of 1862, wrote to a friend: “No amount of money can pay a man for going through what we have had to suffer lately.”

The English-born Waud and Theodore Davis were the only specials who remained on assignment without respite, covering the war from the opening salvos in April 1861 through the fall of the Confederacy four years later. Davis later described what it took to be a war artist: “Total disregard for personal safety and comfort; an owl-like propensity to sit up all night and a



SITE UNKNOWN, CIRCA 1864

Sketching a wounded soldier, Winslow Homer added depth learned from the old masters and his fellow artists.

hawk style of vigilance during the day; capacity for going on short food; willingness to ride any number of miles horseback for just one sketch, which might have to be finished at night by no better light than that of a fire.”

In spite of the remarkable courage these men displayed and the events they witnessed, their stories have gone unnoticed: Virginia native son and Union supporter D. H. Strother’s terrifying assignment sketching the Confederate Army encampments outside Washington, D.C., which got him arrested as a spy; Theodore Davis’s dangerously ill-conceived sojourn into Dixie in the summer of 1861 (he was detained and accused of spying); W. T. Crane’s heroic coverage of Charleston, South Carolina, from within the Rebel city; Alfred Waud’s detention by a company of Virginia cavalry (after he sketched a group portrait, they let him go); Frank Vizetelly’s

eyewitness chronicle of Jefferson Davis’s final flight into exile.

Special artists worked fast, identifying a war scene’s focal point, blocking out the composition in minutes, and fleshing it out later in camp. They took great pride in making their renderings as faithful as possible. Writing from the front lines in northern Virginia in the spring of 1862, Edwin Forbes noted that his sketches had been made “at considerable risk for the country is overrun with small gangs of sneaking Secessionists, who are as blood-thirsty as [Confederate Gen.] Albert

Civil War Sketch Book: Drawings From the Battlefield, by Harry Katz and Vincent Virga, is being published this month by W. W. Norton & Company. Richard Barnes documented Civil War reenactments using a wet-plate process, the photographic technique of that era.

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Centre, Sunday

Gnesser's Battery
Asperan

5 men & 48 horses

Trees etc. very accurate
Shell burst in the spot killed
killed 6 horses & wounded all the position
and tore Sergeant Josey previously wounded
in pieces

Gen. Mc Clellan's
Headquarters



morning

Capt. Timony commanding 46th

the Retreat.

killed & many wounded

"Shell burst in the spot sketched [center left] killed 6 horses & wounded all the position [sic] and tore Sergeant Tosey previously wounded in pieces," wrote Henri Lovie. He called this scene the Union's "Desperate Retreat."

BATTLE OF SHILOH, TENNESSEE, APRIL 6, 1862



Edwin Forbes noted that his sketches had been made “at considerable risk



Pike. For one day I got an escort of ten men and made some sketches in comparative safety... All who have seen them say they are very accurate. I need hardly assure you that I do my best to make them so, as fidelity to fact is, in my opinion, the first thing to be aimed at.”

The artists dispatched their sketches from the battlefield by horse courier, train, or ship to the publisher’s office, where a home artist copied the image onto blocks of wood. Engravers then carved different sections of the drawing, the most experienced of them working on detailed figures and complex compositions, and the apprentices taking on the simpler background tasks. Once the engraving was completed, it was electrotyped—copied onto metal plates in preparation for printing. The engravings could also be copied and sent overseas to foreign publishers for added revenue. Usually it took two to three

weeks for the drawn image to appear in print, although important events or battles could be rushed into print in a matter of days.

TWO PICTORIAL WEEKLIES dominated the national scene in 1861, both published in New York City: *Frank Leslie’s Illustrated Newspaper* and *Harper’s Weekly*. Before immigrating to America, veteran English pressman Henry Carter—known by his pen name, Frank Leslie—had managed the engraving department at the *Illustrated London News*, the world’s first and most prestigious pictorial weekly. Even before the war began, *Leslie’s*, which debuted in 1855, routinely boasted print runs above 100,000, and special editions could top three times that number.

The journal claimed to be strictly neutral, and within months of President Lincoln’s election in November 1860, Leslie sent William Waud,

for the country is overrun with small gangs of sneaking Secessionists.”



EDWIN FORBES, SECOND BULL RUN CAMPAIGN, VIRGINIA, AUGUST 28, 1862

Near Bull Run, Union Gen. John Pope's Army of Virginia plods through a pummeling summer rainstorm in search of Rebel forces.

Alfred's younger brother, to Charleston to document the growing secessionist sentiment. Also English-born, William could claim neutral status and reasonably represent his publisher's desire "to produce a paper which shall be so entirely free from objectionable opinions or partizan views of national policy, that it can be circulated in every section of the Union and be received in every family as a truthful exponent of facts as they occur." William Waud's sketches predate the attack on Fort Sumter and offer a glimpse into the last days of the prewar South. He was sketching among the crowds watching from the seawall as Confederate guns fired on Fort Sumter.

In contrast to Frank Leslie, Fletcher Harper—publisher of *Harper's Weekly* and a scion of the renowned Harper Brothers literary publishing house—stood firmly with the Republican Party, President Lincoln, the abolitionists, and the

Union. His views, his reporters, and his pictorial weekly, which had started in 1857, were decidedly not welcome in Secessia. Initially *Harper's* was more literary than journalistic, befitting the journal's erudite heritage. The war changed all that. By the beginning of the second year, Harper had hired top talent—including Alfred Waud, Winslow Homer, and Thomas Nast—giving the artists the resources to fill the journal's pages with compelling and persuasive war images.

Alfred Waud, the most prolific special, created many of the most memorable sketches of critical moments at Antietam and Gettysburg, where he was the first artist to arrive on the field. On July 21, 1861, he traveled to the Bull Run battlefield in the photographic wagon owned and driven by his friend Mathew Brady. Already known as a boon companion and crack artist, at Bull Run Waud took up arms against the Confederates.



View from Mr. Muma's house and farm

Confederates set Samuel Mumma's farm ablaze to keep it from Union hands. By the time Alfred Waud made this sketch, using Chinese white pigment to depict flames, Union troops were in control of the area.

BATTLE OF ANTIETAM, MARYLAND, SEPTEMBER 17, 1862



Red caisson blowing up -

ns at the height of the 17th Sept

The artists dispatched their sketches by horse courier, train, or ship to the



3

of the federals
 "The battle of Fredericksburg, Va. Franklin's
 Marye's Hill of the battery of the Washington Artillery."

The attempt of the federals to carry the point of the
 Confederate positions on their right, was totally
 unsuccessful & disastrous to them. Probably as many as
 25,000 men were hurled at intervals on the hill &
 woods shown in my sketch but at each attack they
 were driven back with immense loss. From the
 point where I stood with General Lee & Longstreet I
 could see the grape & canister from the guns of the
 Washington Artillery move great masses in the masses
 of federal troops rushing to the assault, while the infantry
 fought behind a breastwork just under the battery
 decimated the rearward columns of the enemy. In the
 distance Franklin's corps is seen deploying into lines
 of battle on the Federal left; they have some field
 batteries thrown forward, shelling the Confederate positions
 on the wooded house opposite. A portion of Fredericksburg

is seen in the rear of the attacking forces & beyond
 is the range of heights on the opposite side of the river
 from which the northerners have heavy guns firing
 on Marye's Hill, to cover the advance of their men.
 Numbers of their shells are bursting over the confederate
 soldiers in the breastwork; it was here General Cobb
 was killed & it is his bugabe acting as sharpshooters
 At the back of this hill a South Carolinian had a
 portion of his head carried away, within forty yards
 of myself, by a shell from the ~~right~~ ^{right} ~~side~~ ^{side} of the
~~Confederates~~
 after the battle, I counted six hundred & sixty dead
 lying on a small plot of ground, scarcely 4 acres in extent,
 the hill shown in the illustration & altogether 1493
 were buried between the hill & the town, 800 were
 buried on that part of the field ~~and~~ occupied by
 Franklin - these were all federals. This makes the
 Northern dead on the right & left amount to 2293.
 The federals beside this buried many within their own lines on
 the ~~side~~ ^{side} of the hill.

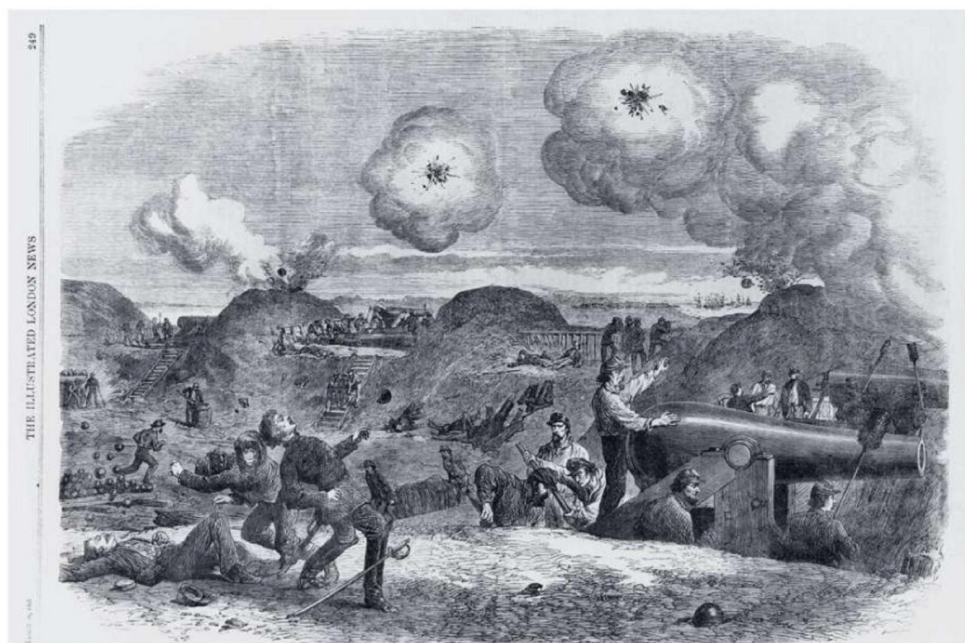
On the back of his sketch of Confederates defending Marye's Hill near Fredericksburg, Frank Vizeley noted that "after the battle, I counted six hundred & sixty dead laying on a small plot...scarcely 4 acres in extent."

publisher's office, where a home artist copied the image onto blocks of wood.



FORT FISHER, NORTH CAROLINA, JANUARY 13-15, 1865

English war artist Frank Vizetelly huddled inside Fort Fisher while it was being shelled by more than 50 Union warships. His drawing of the attack (above) ran two months later as an engraving (right) in the Illustrated London News.



“Surrounded as I am by the Southern people...I emphatically

The next day, returning from the field, he pulled his pistol on a Union soldier attempting to commandeer his horse. Gen. George Meade often favored Waud with requests to sketch Rebel defenses, offering him special access. Waud enjoyed close relationships with numerous officers but also reveled in his life with the common soldier.

As the war progressed, no artist portrayed life in camp more intimately than *Leslie's* Edwin Forbes, who often focused on human-interest and figure study. His sketches of soldiers relaxing, cooking, cleaning, reading, shaving, and engaging in sports and other daily activities record their shared existence and collective humanity.

Winslow Homer, born in Boston, Massachusetts, and destined for artistic stardom, created some of his most celebrated paintings from sketches he made as an illustrator at the front. During the Peninsular Campaign in Virginia—Gen. George B. McClellan's initial, unsuccessful assault on Richmond in the summer of 1862—Homer brought remarkable verve to his work but chafed at the restrictions of military life. In addition, according to his mother, he “suffered much, was without food 3 days at a time & all in camp either died or were carried away with typhoid fever... He came home so changed that his best friends did not know him.”

Homer's Bavarian-born colleague, Thomas Nast, became America's most influential editorial cartoonist. Supporting the Lincoln Administration and Republican Party, he demonized the Rebels and advocated for emancipation, heaping derision on those in the North who opposed the war effort and sought negotiated peace with the Confederacy. By 1864, coverage of the Union victories by the special artists, along with Nast's acerbic illustrations, helped consolidate public support for the war effort and win Lincoln a second term. Senior officers on both sides came to value the military knowledge of the specials, offering them commissions and employing their skills as scouts to sketch fortifications.

The artists had no control over their work after it left the field. At the December 1862 Battle of Fredericksburg, Arthur Lumley, a Dublin-born Irishman working for the *New-York Illustrated*

News, sketched Union troops pillaging the town. Incensed, he wrote on the back of the drawing: “Friday Night in Fredericksburg. This night the city was in the wildest confusion sacked by the union troops=houses burned down furniture scattered in the streets=men pillaging in all directions=a fit scene for the French revolution and a disgrace [*sic*] to the Union Arms.” The journal never published the inflammatory image.

Both Harper and Leslie did their part to shape public opinion, censoring images considered too negative or graphic and altering drawings to make them more stirring or upbeat. *Harper's* editors, for instance, made Alfred Waud's drawing of a leg amputation at an Antietam field hospital look less gory to accommodate squeamish readers. Engravers freshened another Waud sketch of exhausted horses dragging artillery carts, giving them lifted heads and spirited tails and making them kick up clods of mud—an animated portrait of teamsters racing ammunition to the front.

Nonetheless, by depicting scenes as realistically as they could, Waud, Lumley, Henri Lovie, and others undermined the popular myth of the war as a romantic adventure. As citizens grew accustomed to the violent imagery, censorship eased.

ALTHOUGH THE CONFEDERACY had virtually no pictorial press, specials operating in southern theaters created hundreds of images. One outlet was the *Illustrated London News*. With Lincoln's election, the British took a keen interest in American affairs, and after the war started, debate over whether to recognize the Confederacy consumed politicians and the public. In May 1861 the veteran British war artist Frank Vizetelly arrived in America fresh from covering Giuseppe Garibaldi's campaign to liberate the Italian peninsula from Austrian rule. Vizetelly's initial impressions of the Union Army were favorable, and he reported back to London of patriotic fervor, high morale, and camp camaraderie.

That changed on July 21 at the Battle of Bull Run, a Union debacle. A week later Vizetelly contributed an unflattering sketch, “The Stampede From Bull Run,” along with this blunt description: “At half-past five the Federal troops

assert that the South can never be subjugated.” —Frank Vizetelly



WILLIAM WAUD, SIEGE OF PETERSBURG, VIRGINIA, SEPTEMBER-OCTOBER 1864

Union hospital attendants collect the wounded after a skirmish in the ten-month campaign for Petersburg.

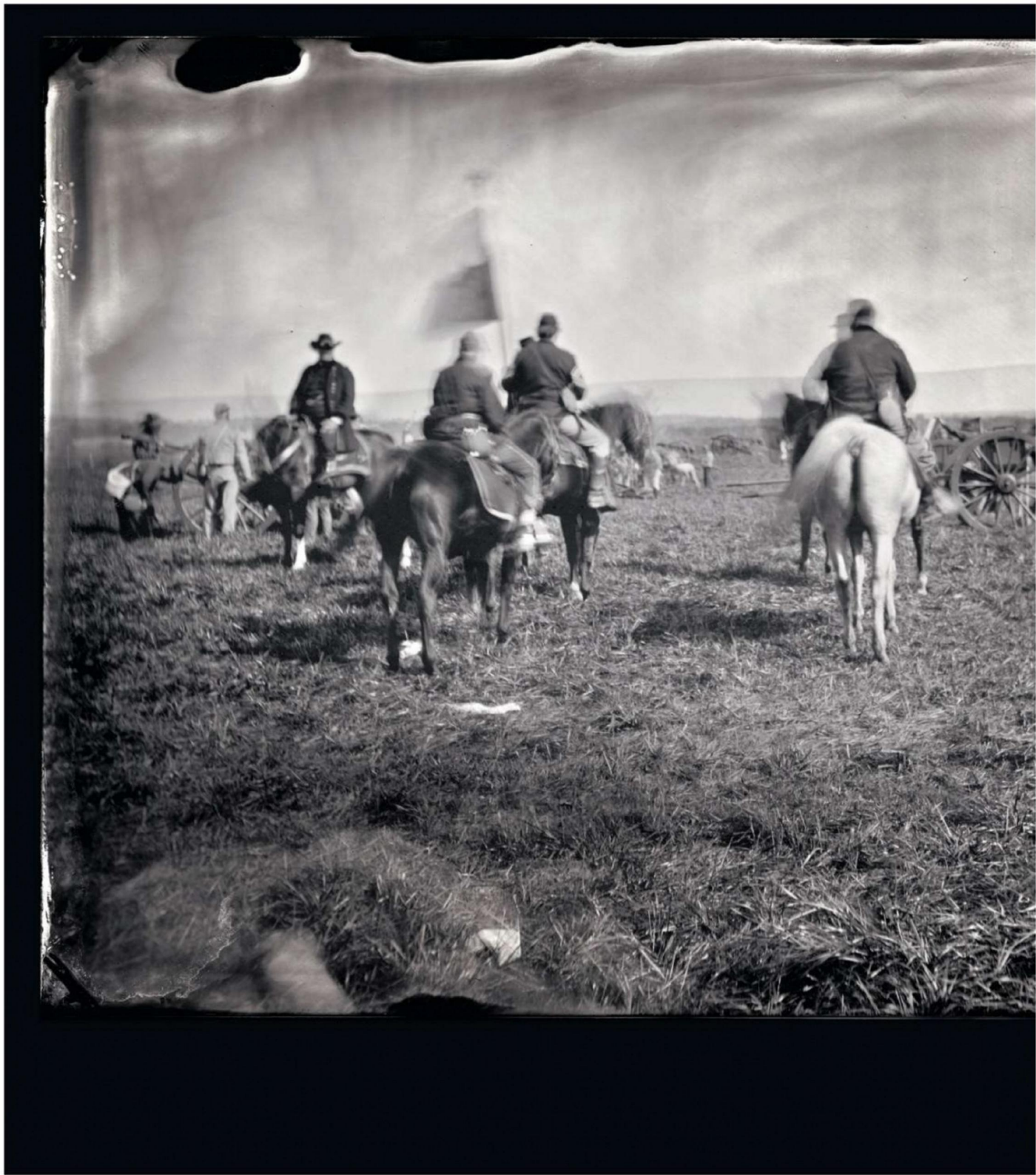
were in full retreat, pursued at different points by the black horse cavalry of Virginia. Retreat is a weak term to use when speaking of this disgraceful rout... The terror-stricken soldiers threw away their arms and accoutrements, herding along like a panic-stricken flock of sheep, with no order whatever in their flight... Wounded men were crushed under the wheels of the heavy, lumbering chariots that dashed down the road at full speed. Light buggies, containing members of Congress, were overturned or dashed to pieces in the horrible confusion of the panic.”

Vizetelly, now banned from the Union lines, was determined to get to the Richmond front, and the following summer he simply assigned himself to the Confederate States Army. With the help of Confederate sympathizers and a freed slave, he crossed the Potomac below the capital and joined Lee’s army along the Rappahannock River. Taking up the Rebel cause, he wrote: “Surrounded as I am by the Southern people...

I emphatically assert that the South can never be subjugated.” Vizetelly loved the officers, the soldiers, the people, the land, and the cause of the Confederacy. For the first time in the war, the South had its own special artist, although he worked for a newspaper published in London.

Some northern artists advocated openly for black emancipation. In May 1866, a year after hostilities ended, Alfred Waud created an emotional and symbolic coda to the war with his portrayal of black troops mustering out in Little Rock, Arkansas. Many specials turned to sketching the American scene as soldiers dispersed and people returned to peaceful living.

Within a generation sketch artists were eclipsed by photographers using Kodaks. But even today, artists are still going to battlefronts—in Afghanistan, for instance—sent by the military and the media to interpret warfare in ways cameras cannot, capturing for the record the inner life of the soldier caught up in a larger drama. □



A
SKETCH
IN
TIME

Part Two

CIVIL WAR REENVISIONED

PHOTOGRAPHS BY RICHARD BARNES

The Civil War maintains a strong grip on the American imagination, especially for those who reenact the conflict's battles. Seeking authenticity, reenactor units may have specific rules: Union forage hats must be indigo, not navy blue; no coon tails are allowed on Confederate hats; trappings like modern eyeglasses and wristwatches are off-limits. Richard Barnes aims for a different sort of authenticity in his images. He works with equipment that Civil War-era photographers would recognize. He uses a wooden camera, aluminum plates coated in collodion and dipped in silver nitrate, and an ice-fishing tent as a darkroom. The plates dry quickly, distressing the photographs around the edges, making them look historical. But rather than excluding the modern world, he intentionally reveals it: soldiers mustering near portable toilets, rows of parked cars beyond the battlefield. These evoke what Barnes calls "the slippage of time"—moments when past and present collide.

Cavalry cede the field to a truck hauling away cannon after a reenactment of the crucial Union victory at the 1864 Battle of Cedar Creek, Virginia.







Warren Swartz depicts Confederate Gen. William Mahone, and Jacqueline Renee Milburn plays Mahone's wife, Otelia Butler Mahone. You can't "relive a person's life," Milburn says, "but you can give a sense of it."





Union reenactors prepare to take to the field on the 150th anniversary of the July 21, 1861, battle at Bull Run, Virginia. The Confederates won that fight, presaging a bloodier war than anyone had imagined.





The Virtuoso

Deep in the cloud forest of South America the tiny club-winged manakin sings with its wings. Scientists are only beginning to learn how this complex, strange, and highly entertaining behavior evolved.

A club-winged manakin lifts its wings to make music.



BY

Dan Koepfel

PHOTOGRAPHS BY

Tim Laman



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TO SEE A MANAKIN IN ACTION is to encounter a spectacular song and dance act in the middle of a tropical forest. About half of the 40 known species make music by moving their body parts. And in the flush of courtship, males execute maneuvers with names like the dart, the about-face, the upright, and the backward slide (which looks exactly like a Michael Jackson moonwalk).

Charles Darwin sized up the manakin in *The Descent of Man*. In his 1871 account of the bird, he wrote: “The diversity of the sounds...and the diversity of the means for



producing such sounds, are highly remarkable. We thus gain a high idea of their importance for sexual purposes.” But the mechanics of its music making have taken more than a century to uncover.

Just a handful of ornithologists study the club-winged manakin, which lives in Colombia and Ecuador. Probably none is more in tune with the bird than Kim Bostwick. It was Bostwick—first working with her Ph.D. adviser at Yale, Richard Prum, and then since 2002 as curator of birds and mammals at the Cornell University Museum of

Crouching in the dense bush of the Tiputini Biodiversity Station in Ecuador, Cornell University ornithologist Kim Bostwick listens, watches, and waits for a striped manakin. At left, a male club-winged manakin in the Milpe Bird Sanctuary, with his characteristic red thatch, has just attracted a female with his sound and now hopes to seal the deal.



Stay-at-home birds

The club-winged manakin's range stretches through the cloud forests of southwest Colombia and northwest Ecuador. The bird is a homebody, living in colonies that occupy the same patches of land year-round.

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Vertebrates—who broke the code of the male club-winged manakin, a standout among manakins. It is the only species that uses its feathers to generate a *tick, tick, ting* in the hope of making a female swoon.

Scientists knew the wings were the source of the sound but didn't know exactly how the process worked. To crack the conundrum, Bostwick recorded the bird's movements on a video camera operating at a thousand frames per second, more than 30 times as fast as a standard camcorder. Viewing the video a few frames at a time led to a eureka moment: The bird was knocking its wings together 107 times a second. Examining the bird's secondary feathers in the lab, Bostwick saw on each wing a specialized feather with seven separate ridges. The fifth feather rubs against the ridged feather in a plectrum-like action—in music terminology, that's a plucking device, like a guitar pick—to reach a frequency of an astonishing 1,500 cycles per second (seven ridges, each plucked twice = 14, multiplied by 107 = 1,498). The result is a violin-like tone, somewhere between an F sharp and a G, more than two octaves above middle C. The world has nearly 10,000 species of avifauna, but no other creates sound this way—by scraping body parts together (although crickets do something similar).

Bone density appears to be critical. In a paper that will be published later this year, Bostwick and her colleagues describe how they conducted micro-CT scans of manakin wings and discovered that the wing bones are solid. Most birds have hollow bones, which lighten the load when aloft. The manakin's bulky bones, Bostwick says, likely have evolved in order to support the knocking action of the large feathers. But how, she wants to know, does this three-and-a-half-inch bird haul around the extra weight when it flies? And how does it manage “the incredible energy cost and physics involved in using that wing”? These are the next manakin mysteries to solve. □

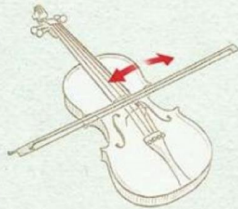
Dan Koeppel is the author of To See Every Bird on Earth. Tim Laman explored the lairs of bowerbirds for our July 2010 issue.

Playing his wings

To woo a mate, the male club-winged manakin dances, knocks his wings, and makes music: a *tick*, and then, if the female is interested, a violin-like *ting*. No one knew how the bird made the sounds until ornithologist Kim Bostwick used high-speed video and lab studies to find out.

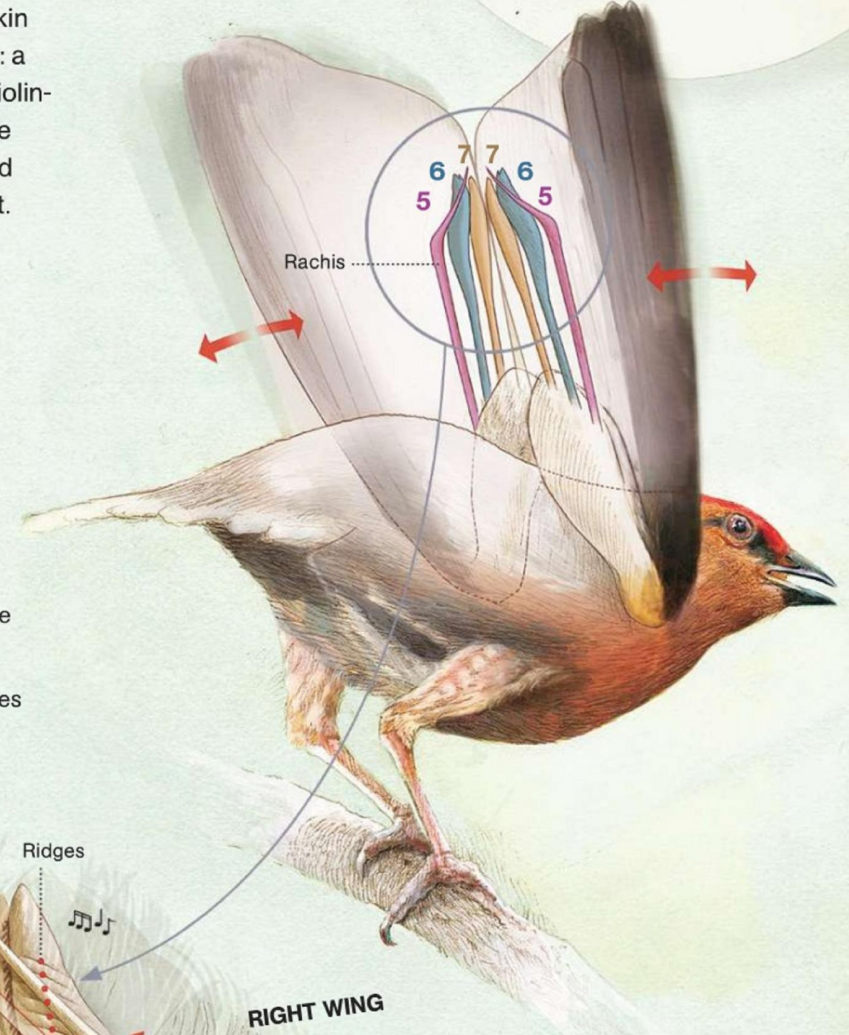
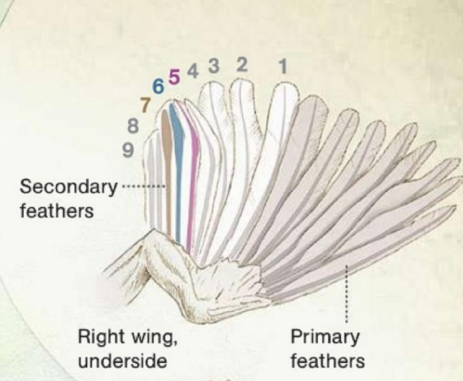
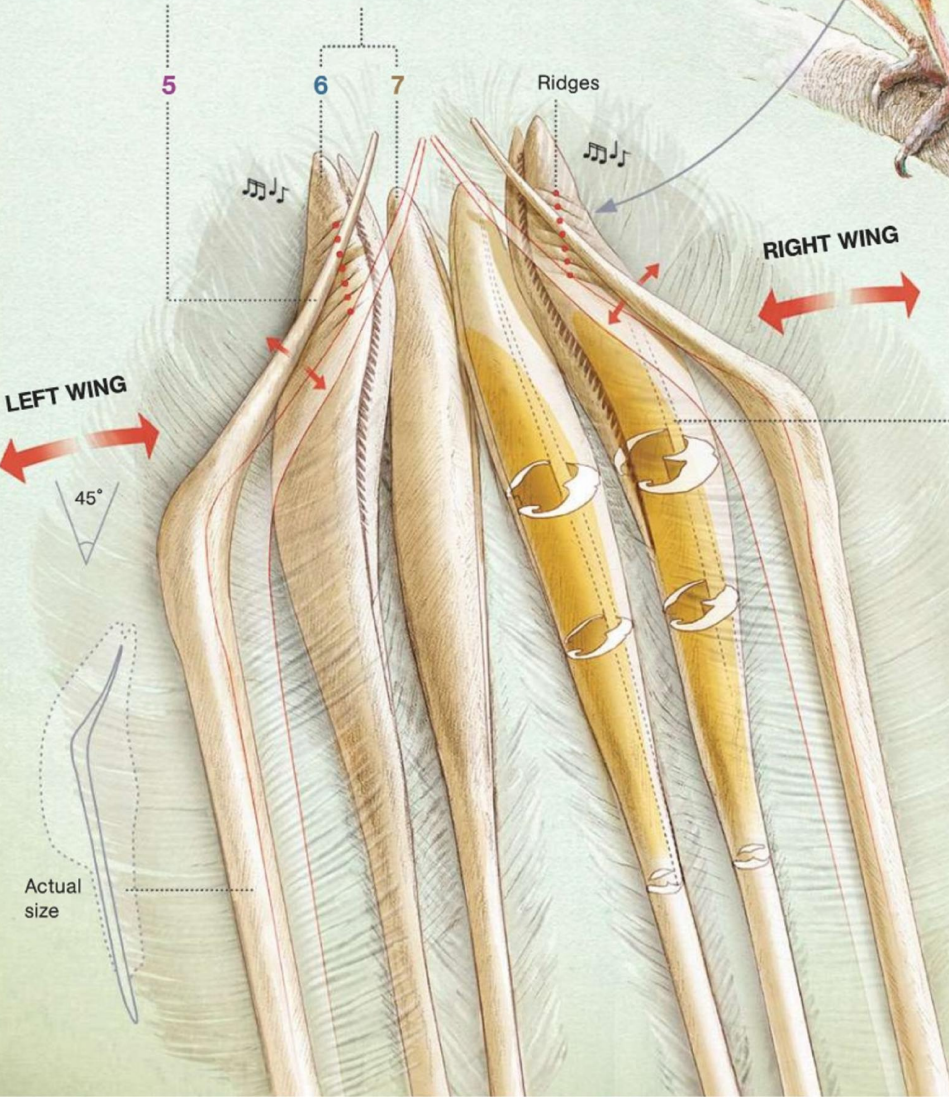
A feathered violin

The club-winged manakin knocks his wings together 107 times a second to create sound.



Feather 5 is bent at a 45-degree angle and tapers to a blade. When the wings collide, it slides across the ridges on feather 6 like a bow.

Feathers 6 and 7 are enlarged and club shaped. Feather 5's bowing action creates vibrations in these two feathers.



The sounds 
The vibrations of thick-walled feathers 6 and 7 spread to all secondary feathers; a tone rings out.

One knock of the wings creates *tick*. A series of knocks yields *ting*.



ART: FERNANDO G. BAPTISTA, NGM STAFF
RESEARCH: TONY SCHICK
SOURCE: KIM BOSTWICK, CORNELL UNIVERSITY MUSEUM OF VERTEBRATES

iPad Exclusive
See the feathers knock together—and hear the *ting*—on our iPad edition.



The manakins featured in this gallery, photographed in a tropical Ecuadorian forest, aren't capable of their club-winged cousin's musicality. These close relatives are being studied by ornithologist Kim Bostwick in the hope that they may reveal intermediate evolutionary steps that led to the club-winged's virtuosity. Above, the wire-tailed manakin—note the spiky tail



PIPRA FILICAUDA



MACHAEROPTERUS REGULUS



LEPIDOTHRIX CORONATA



PIPRA ERYTHROCEPHALA

feathers—courts a female. At right, the striped manakin (top) has enlarged secondary feathers like the club-winged but makes only a simple buzzing sound with its wings. The blue-crowned manakin doesn't produce any wing sounds. The golden-headed manakin (bottom) moves its wings like the club-winged manakin but does so silently.





EGYPT IN THE MOMENT

**IN THE WAKE OF
THE ARAB SPRING,
THE COUNTRY
IS FULL OF
UNPRECEDENTED
HOPE—AND
GNAWING
FEAR.**

Herodotus called Egypt the
“gift of the river” because
the country would be a
sandy wasteland without the
Nile’s nourishing waters.

Impassioned crowds have returned to Tahrir Square in waves of unrest in the months after President Hosni Mubarak stepped aside. "Down with military rule" has been a persistent refrain.





الدولة
منطقة عمل

MOVIE AMERICA
U.S.A.



The gently flowing Nile is a place to escape the frenzy of Cairo's chaotic streets, particularly in the evening. Egyptians stroll along the bridges or take a cruise on one of many colorfully lit riverboats.



مصر ٢٠٢٩
قمر ١٤
مصر ٢٠٢٩



At a museum devoted to the 1973 war with Israel, teenagers view a giant panorama of the fighting. Early victories restored a sense of national pride.



“T **HIEVES AND THUGS”**
IS OUR TAXI DRIVER’S
DESCRIPTION OF THE
PEOPLE WE WILL MEET
ON THE THIRD-CLASS
TRAIN FROM ASWAN
TO LUXOR. THIS SEEMS
TO BE A COMMON
VIEW IN THE EGYPTIAN
COUNTRYSIDE AFTER
THE REVOLUTION:
WATCH OUT FOR YOUR
SAFETY AND AVOID
THE RIFFRAFF. AT THE

train station a scowling police officer manning the gate won't let me pass. "No foreigners are allowed on third class," he barks. "Forbidden!"

I'm traveling in the fall of 2011 with an Egyptian colleague, Khaled Nagy, who has spent more than 200 days and nights chronicling the rebellion in Cairo. We're on our way from Abu Simbel in the distant south of Egypt to the Mediterranean city of Alexandria in the north, with many stops along the way. The idea is to travel far from the epicenter of the revolution, Tahrir Square, to see how the changes are playing out in the rest of Egypt.

After much argument and a four-hour delay, we eventually make our way aboard a train. We quickly pay the ticket collector 21 Egyptian pounds, or about three and a half dollars, for two fares to Luxor, more than three hours away.

In our car several of the windows are cracked or broken; many are jammed open to let outside air whip through. This is necessary because

there is no air-conditioning in the still-hot days of autumn and also because an acrid smell from the toilets permeates the cars when the air inside is stagnant. A flap to an electrical panel swings open and shut against the wall, and the glass case to the fire extinguisher is smashed in. The extinguisher seems intact.

Some passengers sit motionless, their weary eyes fixed on some invisible point outside the train. A few chat on cell phones. A gap-toothed woman, clad in a black dress common to peasants, carries a cardboard box with three chickens in it. Occasionally one of the birds escapes, flapping its wings and clucking madly.

Men and boys walk up and down the aisles selling tissues, watches, wallets, sewing kits, polyester blankets, cold water in reused plastic bottles, pumpkin seeds, nuts, bread, boiled beans, religious pamphlets, and tea that is poured from giant tin kettles. I get my dusty shoes shined for 50 cents, including a generous tip. A handicapped man slides along the floor on his buttocks, holding up a hand for donations. Across the aisle, a man in a turban points to the view of the palm-fringed Nile from the window and asks, "Do you have a river as beautiful as this?"

As the train rattles along, our fellow travelers gradually warm to us. The passengers we meet, including a muezzin who makes the calls to prayer at a mosque near Luxor and a young man doing his military service in Aswan, seem apprehensive about the revolution. The events of Tahrir are far from their lives. "In the end isn't life simply about being safe?" says the muezzin, who is traveling with his wife and two young children. He complains about the lack of financial security people feel and about a declining economy. He gets a government salary every



Egyptian revolutionaries have battled for freedom and also for dignity. But the economy is suffering, and the challenges are many: unemployment, inadequate education and health care, insufficient housing, and mind-numbing traffic.

month, but others live job to job, some earning as little as ten pounds a day, or less than two dollars. The muezzin may be better off than many, but his wife looks miserable. She spends most of the trip staring blankly out the window, holding a tissue over her nose.

“There is no trust, no security,” says Momen Hassan, the 22-year-old conscript. When I ask his opinion of the revolutionaries in Tahrir, he says, “I’m not against them, but I’m definitely not for them.” He’s not surprised by the misdeeds of the former regime, but he likens corruption to

a tree with deep roots: Cut it down, and over time it will grow back. “Democracy is good,” he says, “but we can’t rush it. If you let the leash go completely loose, people will do whatever they want. We need a firm hand.”

This view is not uncommon in the countryside. Nearly everywhere we go, Egyptians express anxiety about *al amn*—security. Many seem

Jeffrey Bartholet is a former Washington bureau chief at Newsweek magazine. Alex Majoli, a Magnum photographer, covered the Arab Spring.



A man at the Giza Pyramids, eager to sell rides to foreigners on his elaborately adorned camels, shows a photo of better days for his business. The number of visitors to pharaonic tombs and temples has fallen dramatically.

almost paranoid about growing thievery, which was nearly unheard of in Egypt before the revolution, and a potential breakdown in order. A taxi driver in Luxor has bought a Beretta pistol to keep under his seat. Some Egyptians speak darkly of smugglers bringing guns across the border from Libya.

IN THE SHADOW OF THE PHARAOHS

The anxiety and tension alone may be enough to drag the country down. Tourism is a major contributor to Egypt's economy, yet the tourist

sites we visit are all but deserted. At the temple of Ramses the Great at Abu Simbel, souvenir kiosks at the entrance are shuttered, and metal turnstiles are still. Watchmen dressed in galabias look out over Lake Nasser, waiting for fish or crocodiles to poke ripples in the placid surface of the water.

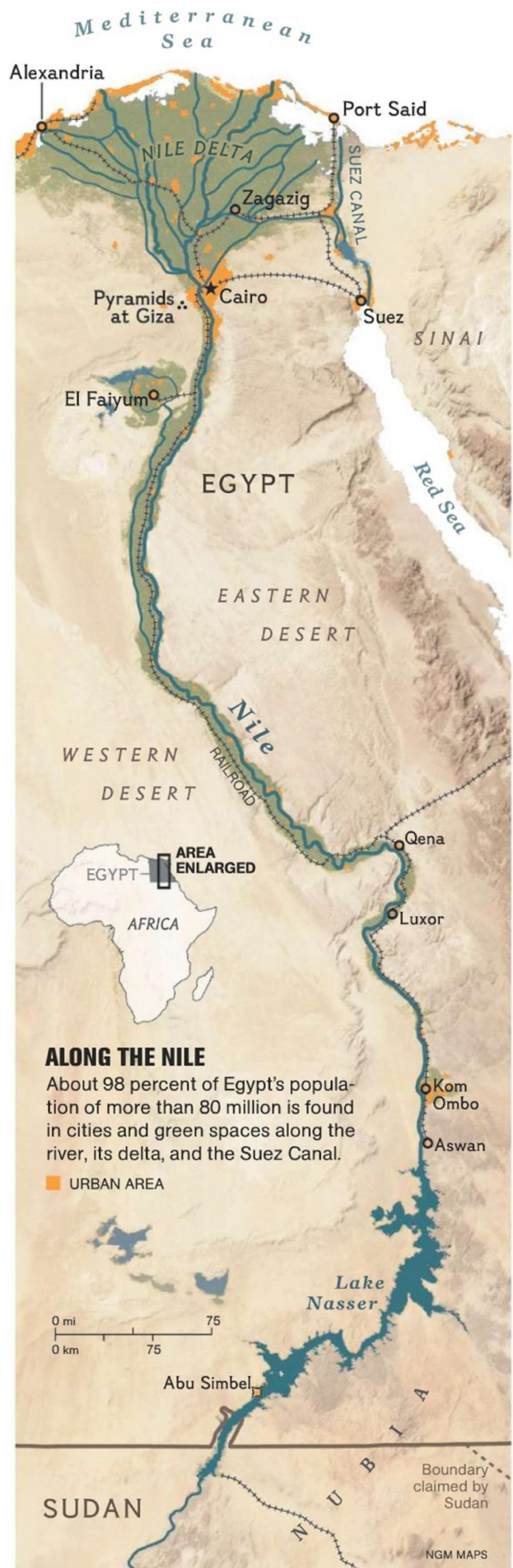
Inside the temple itself there are no jostling tourists. No scents of European perfume, no complaints about the heat or the hassles of travel to flyblown corners of the globe. No tour guides explaining why Ramses II is slaughtering the

Hittites in one ancient wall relief or stabbing and stomping Libyan enemies in another. During normal times up to 3,000 foreign tourists would visit this site on a busy day. They'd file through the hall, flanked by eight massive statues of the pharaoh, to reach the inner sanctuary, the holy of holies, where rays of sunlight penetrate precisely twice a year. But eight months after the Egyptian revolution ousted President Hosni Mubarak from power, the number of visitors has plunged to about 150 a day. At four on a Saturday afternoon no other foreigner is in the complex. No one else at all is inside the temple. A solitary swallow flits among the columns.

Just outside, in the shadow of four colossal statues of Ramses, Ahmed Saleh invites me to sit on a wall and have a glass of hot tea. Saleh is an Egyptologist and the general director of Abu Simbel and other monuments in the region of Nubia, in the far south of the country near the Sudanese border. "This is the problem after the revolution," Saleh tells me. Much is unsettled, and "tourists are afraid that if they come here, they might be attacked." I mention to Saleh that many Egyptians regard the economic troubles they're experiencing now as a necessary passage. They see Mubarak as the "last pharaoh" and believe that a new era has arrived—a break with more than 5,000 years of history.

Saleh offers a coy smile. "Both Ramses and Mubarak knew how to use propaganda," he says. "Both were military men, and both formed family dynasties." But Saleh is unsure that Mubarak, who was grooming one of his sons to replace him before the revolution, will be the last strongman of Egypt. Pharaohs have been toppled before: Even in ancient times, he says, the aged Pepi II was overthrown in a popular revolt, but dynastic rule returned. "The political life in Egypt has not changed enough to say Mubarak will be the last pharaoh. We're on the edge of democracy, but we're still not there."

Saleh gives many reasons for pessimism: Remnants of the old regime and ruling party remain at many levels of federal and local power. Illiteracy rates are high in Egypt (roughly 40 percent among adults 25 to 65). Many Egyptians see the



The seaport of Alexandria, founded by Alexander the Great in 331 B.C., has become a sprawling, overburdened metropolis. Some Egyptians are lobbying for wide-scale urban renewal to restore its reputation as a gateway to the world.







In Egypt's densely populated cities and villages, it can be hard to distinguish what is being built from what is falling down. These giant stones have been dumped on a roadside southwest of Cairo.



revolution only as an opportunity to grab what they want or to make wage and contract demands. Unlike Eastern European countries that broke free of communism, Egypt is not part of a wider region with a history of democratic practice. “Arabs won’t easily accept democracy,” Saleh says, “partly because it is against the rule of the father in his family or the chief in his tribe. If a father says, ‘Don’t play,’ you don’t play. He is a dictator. How can you change the mentality of the Egyptian in such a short time?”

Such talk of a static mentality seems cynical at best. Yet it’s a recurrent theme, at least in the Egypt that exists beyond Tahrir. It’s an argument made by those, like Saleh, who support the ideals of the revolution but remain cautious and also by those who want to justify autocratic rule. Taken together, the doubts raise many questions: How strong and deep is Egypt’s revolutionary spirit? Are we seeing one revolution with shared goals or many competing revolutions? Is it possible that Egypt will revert to strongman rule—initially less corrupt than Mubarak’s final years and with some superficial freedoms, but fundamentally the same?

AN ISLAMIST VISION

Mohammed Nasser, a young man I met in Tahrir at the height of the protests, in February 2011, is a Salafist, one of those who see the early generations of the Prophet Muhammad’s followers, the *salaf* (forefathers), as representing a golden era that should be emulated. (The Salafists did surprisingly well in Egypt’s 2011-12 parliamentary elections, winning nearly 25 percent of the seats.) Nasser has a long, wispy beard, a shaved upper lip in the manner common among the Salafists, and gentle eyes. When I first met him, he was an unemployed university graduate with a wife and newborn child. He had traveled to Cairo without enough money for the return fare and subsisted there for many days largely on bread and dates.

When I call him on his cell phone months later, Nasser says I’m welcome to visit him at his home in the Nile Delta near Zagazig. Khaled and I arrive bearing bags of fresh fruit, and at

first Nasser wants me to put them back in the car, saying he can’t accept such a gift. He relents, then invites us into the sitting room of his small apartment. Nasser’s wife, who in public wears the billowing black dress and full veil called the *niqab*, never appears from the kitchen. She doesn’t see men in her home who are not part of her family, and when she has female guests over,

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—AHMED SALEH

the men in the apartment must retreat to other places. We are joined by Nasser’s brother-in-law, a bearded English teacher named Abdel Halim Gamal Eddin.

Nasser asks if I’d be more comfortable eating from the coffee table or seated on the carpeted floor, which is customary. I opt for the floor. The food is placed between us: tender beef, which we pull from the bone with our fingers, as well as rice, soup, and *fatta*, an Egyptian casserole of toasted bread and vegetables cooked in meat stock. When Nasser thinks I am not taking enough meat, he hands me a chunk and insists I take more.

I ask whether the revolution has yet had any impact, good or bad, on Nasser’s circumstances. Despite a university degree, Nasser has never landed a salaried job. He earns about 500 pounds (\$83) a month laying floor tile. Like so many other Egyptians, he is part of the country’s vast informal economy, employed day to day, depending on the availability of work. But he didn’t participate in Tahrir because he was frustrated by his financial prospects, he says. “It wasn’t a revolution of the poor. It was a revolution against injustice.”

Even though Egyptians bemoan the relative erosion of public safety after the revolution, few seem wistful about the lower profile of the dreaded state security forces. These are the police who spied on everyone and ran torture cells. Mubarak's regime justified brutal state security as a necessary measure to keep tabs on his enemies, primarily Islamists. After watching militants gun down his predecessor, Anwar Sadat, at a military parade, Mubarak feared the Islamists would try to take power if he didn't keep a firm hand.

Gamal Eddin, 35, tells us he spent four years in prison under Mubarak, apparently because he had been preaching that it is the duty of Muslims to liberate Al Aqsa Mosque in Jerusalem. He seems well respected by the others in the room, perhaps because he is a teacher and perhaps because his prison time gives him status. He smiles often and has a friendly demeanor, even when telling the story of his incarceration. The security forces first grabbed his father-in-law, holding him hostage until Gamal Eddin turned himself in. Then he was sent to an underground dungeon in Cairo, where he was blindfolded and shackled for 38 days. The handcuffs were stamped Made in USA, he says. Then he was sent to another prison, and then another, where he was held until 2010. He was never charged.

Now he wants a president who is "both firm and kind," someone who would apply strict Islamic rule "gradually, so it wins the acceptance of the people." When I mention that one of the Egyptians who plans to run for president is a woman, Nasser and Gamal Eddin shake their heads. Both insist that Islam doesn't allow for that. And the president can't be a Christian either: That would lead to "a lot of troubles" in a Muslim-majority land, they say.

Security forces have just suppressed a Christian protest in Cairo; some two dozen people were killed. Gamal Eddin is quick to note that their village has a "big church" and says, "We don't have an idea to discriminate." When I ask if pharaonic tombs and temples should be destroyed, as some radical Islamists have argued, the two men say they would defer to higher religious authorities. When I press,

Gamal Eddin says that Amr ibn al-As, the Muslim military commander who led the conquest of Egypt in the seventh century, didn't harm the monuments, and that seems like a good precedent. "The revolution isn't finished," says Nasser. But he sees progress. "Before, there was no dialogue about the future. Now there is one."

My colleague Khaled, an adventuresome sort who enjoys music, the company of women, and an occasional glass of wine, admires these two Islamists. He remarks on Gamal Eddin's good-natured optimism despite all he has been through. Egyptians identify with Islamic fundamentalists because they've been "oppressed so long," Khaled says, and also because Egyptians tend to be socially conservative. Many ordinary Egyptians object to the social permissiveness of liberals in the forefront of the revolution. They worry, Khaled tells me, that political changes could make Egypt like "Paris, make us all like Americans."

A MECCA OF MODERNITY

For most of our trip Khaled and I aren't more than a few miles from the Nile, in a verdant valley bordered by desert. Without the river, the country would be a wasteland. Only about 5 percent of Egypt is inhabitable. Beyond the valley lies an inhospitable, sunbaked realm that ancient Egyptians called the "red land."

The towns and villages along the Nile can feel constricted, even claustrophobic. Arriving in Alexandria, breathing the sea air blowing across the corniche from the Mediterranean, is liberating. The city has long been Egypt's gateway to the world. From ancient times it was a cosmopolitan center where many languages were spoken and ideas exchanged. Historian Mostafa El-Abbadi, 83, recalls a city that once boasted 16 daily papers in different languages, including Greek, Italian, English, and Armenian.

The more cosmopolitan aspects of the city began to die out during the era of Gamal Abdel Nasser, who moved to concentrate power more firmly in Cairo. Now Alexandria is overcrowded and impoverished. But some leading Egyptians aim to restore its lost glory.

No place better embodies that effort than



A boy with a toy gun peers at passing street scenes from a car window in Alexandria. Egyptians have high expectations now and want elected leaders to provide the young with greater opportunities.

the Library of Alexandria, a gleaming, modern facility that opened in 2002 a short distance from the site of its Ptolemaic predecessor, the most significant library of ancient times. Visitors enter the main building through large glass doors, then pass through a metal detector. We see people of many backgrounds and ideologies, including women in black niqabs and men in the white galabias and long beards that often signify hard-line fundamentalist beliefs. A woman wearing a *hijab*, the type of veil that covers the hair and leaves the face exposed, is doing research

on Shakespeare, and a young Egyptian man in a flaming pink T-shirt has come to download games and movies, including an action film, *The Fast and the Furious*.

As visitors collect their backpacks and metal objects from the scanner, they stand under a towering abstract sculpture of a nude woman. The sculpture, called "Hypatia," has been cut from slabs of steel and shows the outline of a graceful woman with full breasts. It is named after a female mathematician, astronomer, and philosopher of ancient Alexandria. A placard on

the statue notes that Hypatia was murdered by people “who considered her one of the defenders of paganism and the Classic era, but she was actually a victim of fanatic ideologists.”

In a way, the Alexandria library is more revolutionary than anything that has happened in Tahrir. The facility includes a library for the blind, two children’s libraries, a maps library,

MANY EGYPTIANS SEEMED TO BE WAITING FOR CLEAR PATTERNS TO EMERGE—FOR THE COLORFUL BITS AND PIECES OF A NEW EGYPT TO FALL INTO PLACE.

conference halls, academic research centers, an archaeological museum, art exhibits, a planetarium, Internet-linked computers and Wi-Fi access, 1.24 million books and capacity for six million more. It hosts theater productions and concerts. It has a supercomputer that can make trillions of calculations per second. It has digital archives of Egyptian history and 43 racks of computers that aim to collect every accessible page that has ever appeared on the Internet. Its collections contain books that have been banned elsewhere in the Middle East. Indeed, it is an oasis of free thought in a region where people are, more often than not, told what to think, and then told to memorize it and not to entertain other ideas.

The first and only library director until now, Ismail Serageldin, told the Mubarak regime he wouldn’t take the post unless the library could take care of its own security, without the involvement of the Amn al Dawla, or state security police. “That policy allowed us to have lots of activities. The Amn al Dawla couldn’t come to the Library of Alexandria and give us orders,” says Khaled Azab, director of the special projects department. “You can think and talk about anything inside the Library of Alexandria.”

Most of the 2,700 employees are aged 25 to 35, and the younger generation is included in

all planning and programs, says Azab. During the protests to topple the regime, young demonstrators formed a cordon around the library to protect it from possible harm.

THE JOURNEY AHEAD

Abu Simbel, the towns and villages of the Nile Valley, the Nile Delta, and Alexandria: Every stop on our journey showed us something different. In the end we found that the “other Egypt” beyond Tahrir is a kaleidoscope of jumbled aspirations and fears. Turn the kaleidoscope one way, and you see ordinary Egyptians just scraping to get by, worried that their already difficult lives could get worse; turn again, and deeply idealistic Islamists are hoping to turn Egypt into a theocracy; one more turn, and you find secularists aiming to build a multicultural Egypt with minority rights and guaranteed freedoms for all.

Many Egyptians simply seemed to be waiting for clear patterns to emerge—for the colorful bits and pieces of a new Egypt to fall into place. Some worried the country could come undone; others feared that powerful forces in the military and elsewhere were stoking those concerns in an attempt to retain power. A fundamental divide seemed to exist between those whose thoughts were focused mainly on stability and security, and those who were willing to take risks to achieve real democratic change.

On a mechanized farm in the far south of the country I asked an engineer named Mohammed Haggag about the argument that an authoritarian culture exists in Egypt, deeply embedded within families and tribes, and that a strongman will return. He firmly disagreed. “The relationship between me and my children is very different than the relationship between my father and me,” Haggag said. “When my father said, ‘Stop speaking,’ I stopped speaking. I can’t do that with my own children.”

Did this mean that Haggag, 59, thought the revolution would be a success? “It’s as if we have been lost in the desert,” he said, in a tone that suggested a determination to persevere. “We have found our way, but it will still take a long time to get out.” □





At a camel market northwest of Cairo, minders beat the groaning animals with sticks to keep them in line. The camels shown here, however, have managed to surround a Mercedes.





The long-fiber cotton of the Nile Delta, delicately picked by hand, is considered among the finest in the world. Yet the fertile region is threatened by population pressures and rising sea levels.





A politician from the ultraconservative Salafist Al Nour party teared up on his first day as a member of the freely elected parliament. In past elections Islamist parties were banned.



As protesters and security forces struggle over Egypt's fate, life continues in its usual rhythms. Here a man stands in a trail of smoke left by a small rocket fired in celebration at a wedding in Alexandria.



أحب الكلام إلى الله
سبحان الله والحمد لله ولا إله إلا الله والله أكبر

THE COMMON HAND

The hand is where the mind meets the world. We humans use our hands to build fires and sew quilts, to steer airplanes, to write, dig, remove tumors, pull a rabbit out of a hat. The human brain, with its open-ended creativity, may be the thing that makes our species unique. But without hands, all the grand ideas we concoct would come to nothing but a very long to-do list.

The reason we can use our hands for so many things is their extraordinary anatomy. Underneath the skin, hands are an exquisite integration of tissues. The thumb alone is controlled by nine separate muscles. Some are anchored to bones within the hand, while others snake their way to the arm. The wrist is a floating cluster of bones and ligaments threaded with blood vessels and nerves. The nerves send branches into each fingertip. The hand can generate fine forces or huge ones. A watchmaker can use his hands to set springs in place under a microscope. A pitcher can use the same anatomy to throw a ball at a hundred miles an hour.

The hand is so remarkable that the great Scottish surgeon Sir Charles Bell wrote an entire book in 1833 praising it, *The Hand: Its Mechanism and Vital Endowments, as Evincing Design*. At the time, the notion that life evolved was beginning to circulate, but Bell thought a close look at the human hand would dispel such silly talk. “It presents the last and best proof of that principle of adaptation, which evinces design in the creation,” he wrote.

There’s just one problem with Bell’s argument: It didn’t explain why other species have hands too. No one would doubt that the five fingers at the end of an orangutan’s arm are anything else. In other cases we have to look closer. A bat’s wings may look like sheets of skin. But underneath, a bat has the same five fingers as an orangutan or a human, as well as a wrist connected to the same cluster of wrist bones connected to the same long bones of the arm.

When Charles Darwin wrote *Origin of Species*, he singled out this odd coincidence. “What can be more curious,” he asked, “than that the hand of a man, formed for grasping, that of a mole for digging, the leg

The limbs of a variety of vertebrates—from frogs to elephants to bats to humans (right)—have the same underlying anatomical plan: Five fingers attach to a cluster of bones at the wrist; from there a forearm of two bones leads to one long bone close to the shoulder.



BONES

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five

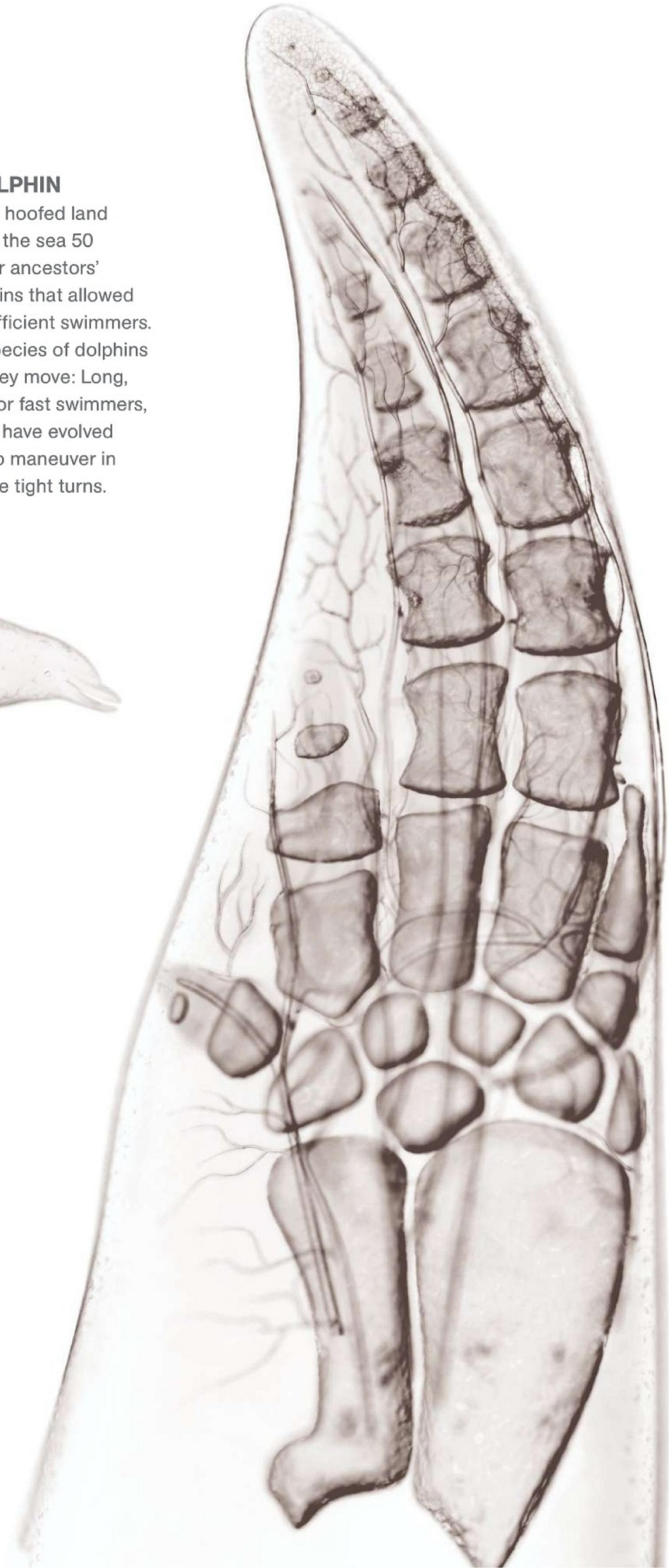
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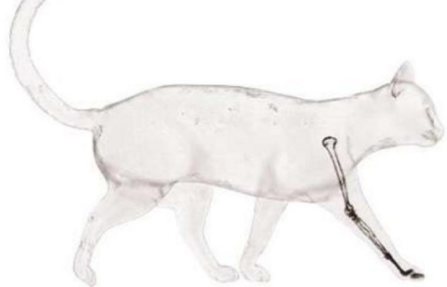
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BOTTLENOSE DOLPHIN

Dolphins evolved from hoofed land mammals that took to the sea 50 million years ago. Their ancestors' hooves changed into fins that allowed dolphins to become efficient swimmers. The fins of different species of dolphins are adapted to how they move: Long, narrow fins are good for fast swimmers, while broad, short fins have evolved in species that need to maneuver in small spaces and make tight turns.





DOMESTIC CAT

Cat hands grow narrow, curved claws. Most of the time ligaments running over the top of a cat's hands keep the claws retracted inside sheaths. To catch prey, a cat pushes off its hind legs and stretches out its arms. Muscles along the top and bottom of its hands contract, which draws the claws out like switchblades. The claws sink into the prey, the cat shifts its weight to its hind legs, and the hands draw the prey to the cat's mouth.



FROG

Frogs have evolved into thousands of species with hands that have changed to accommodate different activities. Some of the species that live in water grow webbed hands so that they can swim. Tree frogs use long fingers with expanded fingertips for climbing; they have even evolved tiny adhesive disks on their fingers that help them stick to smooth surfaces such as leaves.



EARLY HANDS WERE MORE EXOTIC THAN ANY HAND TODAY. SOME SPECIES HAD SEVEN FINGERS. OTHERS HAD EIGHT.



of the horse, the paddle of the porpoise, and the wing of the bat, should all be constructed on the same pattern?”

For Darwin, there was a straightforward answer: We are cousins to bats and to all other animals with hands, and we all inherited our hands from a common ancestor.

IN EXPLORING HOW HANDS HAVE EVOLVED, researchers over the past 150 years have dug up fossils on every continent. They’ve compared the anatomy of hands in living animals. They’ve studied the genes that build hands. Again and again, they’ve found support for Darwin’s contention.

Our hands began to evolve at least 380 million years ago from fins—not the flat, ridged fins of a goldfish but the muscular, stout fins of extinct relatives of today’s lungfish. Inside these lobe fins were a few chunky bones corresponding to the bones in our arms. Over time the descendants of these animals also evolved smaller bones that correspond to our wrists and fingers. The digits later emerged and became separate, allowing the animals to grip underwater vegetation as they clambered through it.

Early hands were more exotic than any hand today. Some species had seven fingers. Others had eight. But by the time vertebrates were walking around on dry land 340 million years ago, the hand had been scaled back to only five fingers. It has never recaptured the original exuberance of fingers—for reasons scientists don’t yet know.

Still, there is a great diversity of hands in living species, from dolphin flippers to eagle wings to the hanging hooks of sloths. By studying these living hands, scientists are beginning to understand the molecular changes that led to such dramatic variations—and to understand that despite the outward differences, all hands start out in much the same way. There is a network of many genes that builds a hand, and all hands are built by variations on that same network. Some sculpt the wrist; others lengthen the fingers. It takes only subtle shifts in these genes to make fingers longer, to make some of them disappear, to turn nails into claws.

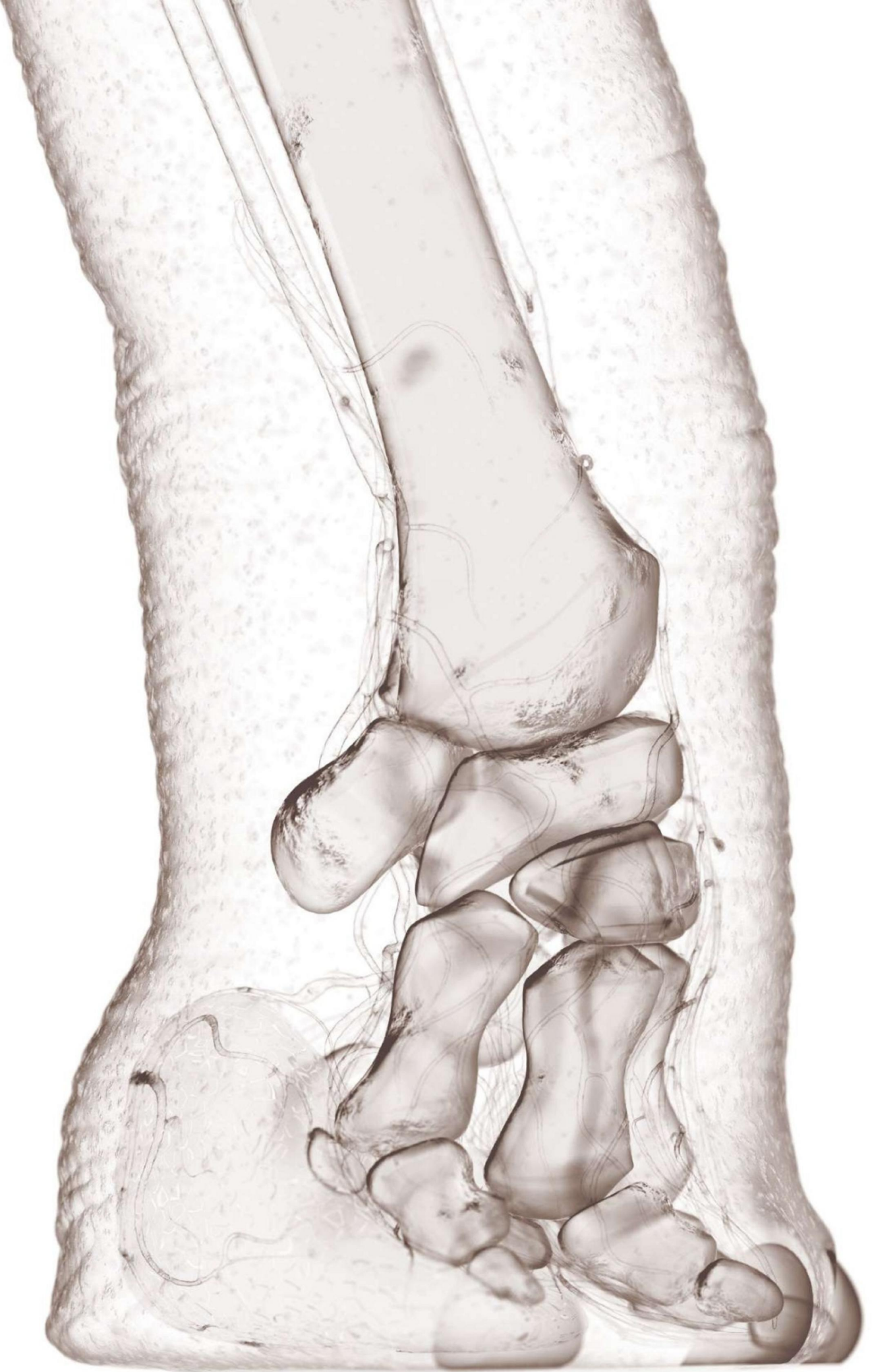
The discovery of the molecular toolbox for hand building has given scientists a deeper understanding of Darwin’s great insight. As different as a vulture’s wing and a lion’s paw may look from the outside, the difference between them may come down to tweaks—a little more of one protein here, a little less of another protein there. Darwin could recognize only the outward signs that hands had evolved from a common ancestor. Today scientists are uncovering the inward signs as well. □

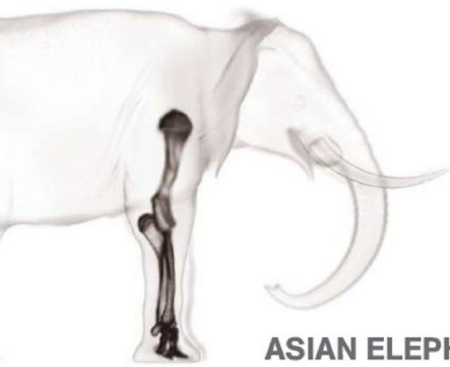
BAT

A bat wing may look like a sheet of skin, but within its flesh are five fingers. The bones act something like tent poles, stretching out the membranous wing so that it can catch the air and lift the bat’s body. By adjusting each finger, a bat can dodge through a forest, hover in front of a flower to feed, or slip into the mouth of a cave.

Carl Zimmer’s latest book, Evolution: Making Sense of Life, co-authored with Douglas Emlen, will be published this summer. Bryan Christie is an award-winning artist and illustrator whose passion is documenting the innate wonder and beauty of the physical world.







ASIAN ELEPHANT

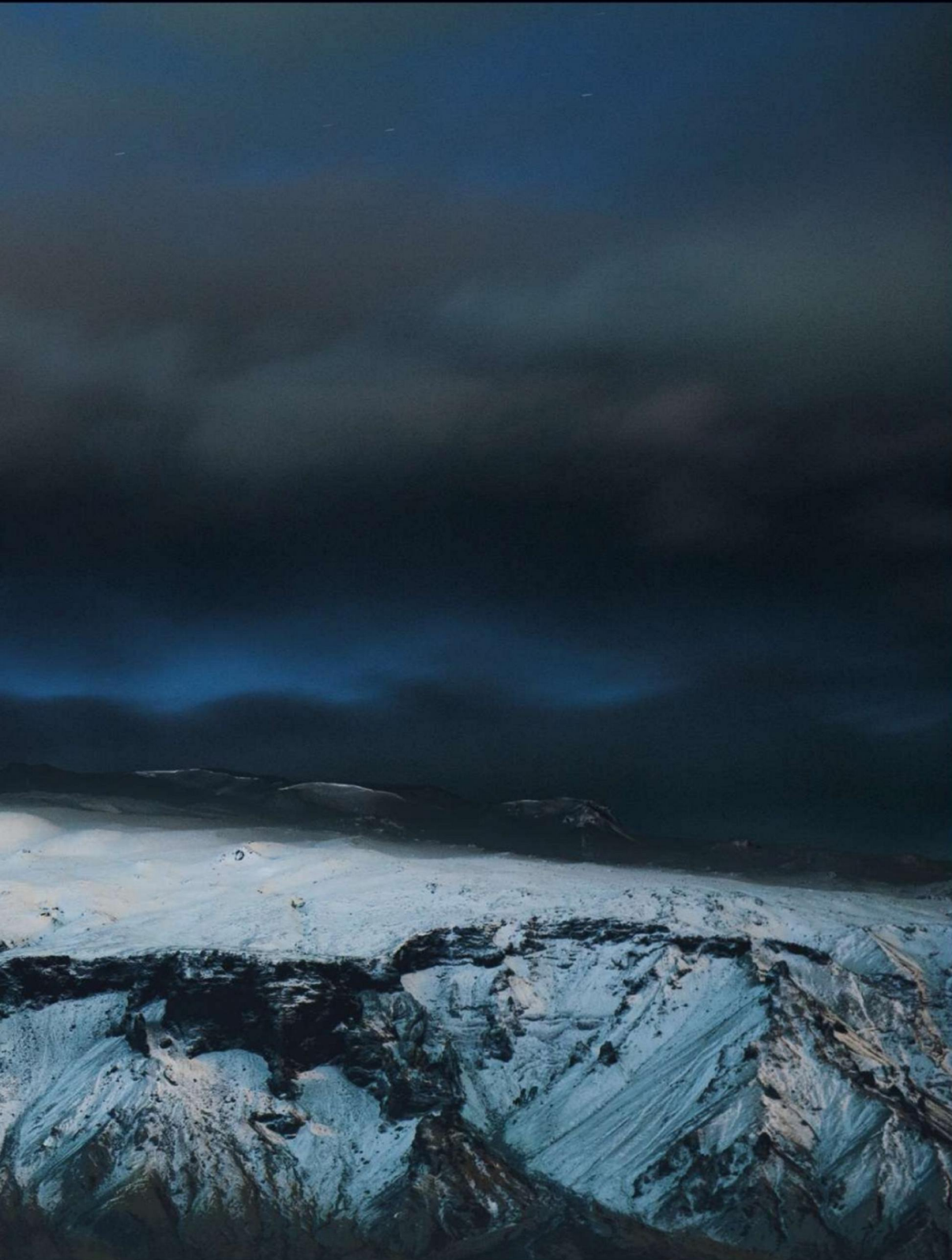
The elephant hand has adapted to withstand tremendous weight. The stout digit bones—recent research shows a sixth “faux” digit that begins as cartilage but grows into bone in some older elephants—function like the base of a pillar. A pad of fatty, fibrous tissue absorbs the shock of each step. Tendons and ligaments store some of the energy as the hand hits the ground and release it as the hand rises. There is literally a spring in the elephant’s step.



AYE-AYE

The aye-aye’s long fingers allow it to get food that’s beyond the reach of other animals in Madagascan forests. One of this lemur’s favorite meals is insect larvae hidden inside trees. It taps one specially designed finger on the bark, listening and feeling for vibrations, and even uses smell to detect the presence of larvae. Then it gnaws a hole. A ball joint at the base of the digit allows the aye-aye to push it through the hole at any angle; a claw hooks the larvae to pull them out.



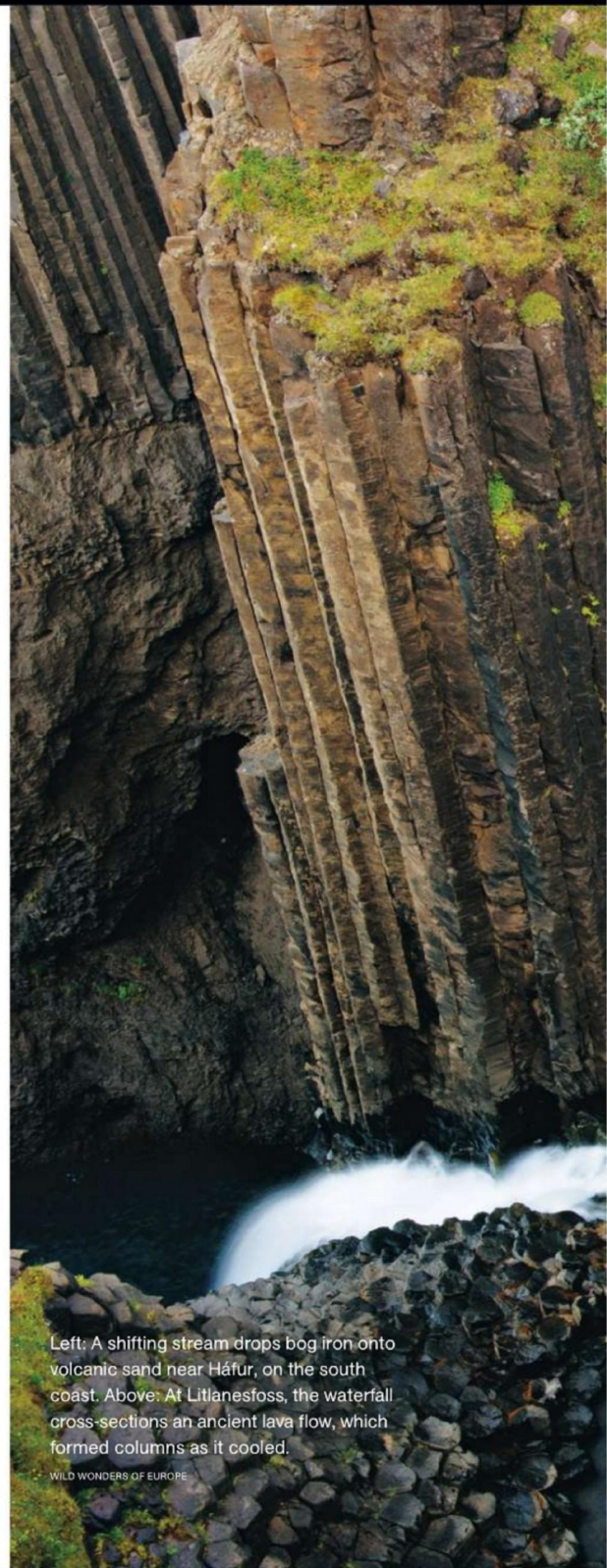


The volcano Eyjafjallajökull, in Iceland, just before dawn on April 23, 2010: The worst is over. Lava flows freely. Earlier, as it punched through the ice cap, it triggered a meltwater flood that destroyed roads and farms, and a steam explosion that hurled ash into the stratosphere, stopping air traffic for a week.

Iceland's Resilient Beauty



Over the centuries, humans (and sheep) have taken a toll on the volcano- and glacier-shaped landscape. But what remains is still spectacular.



Left: A shifting stream drops bog iron onto volcanic sand near Háfur, on the south coast. Above: At Litlanesfoss, the waterfall cross-sections an ancient lava flow, which formed columns as it cooled.

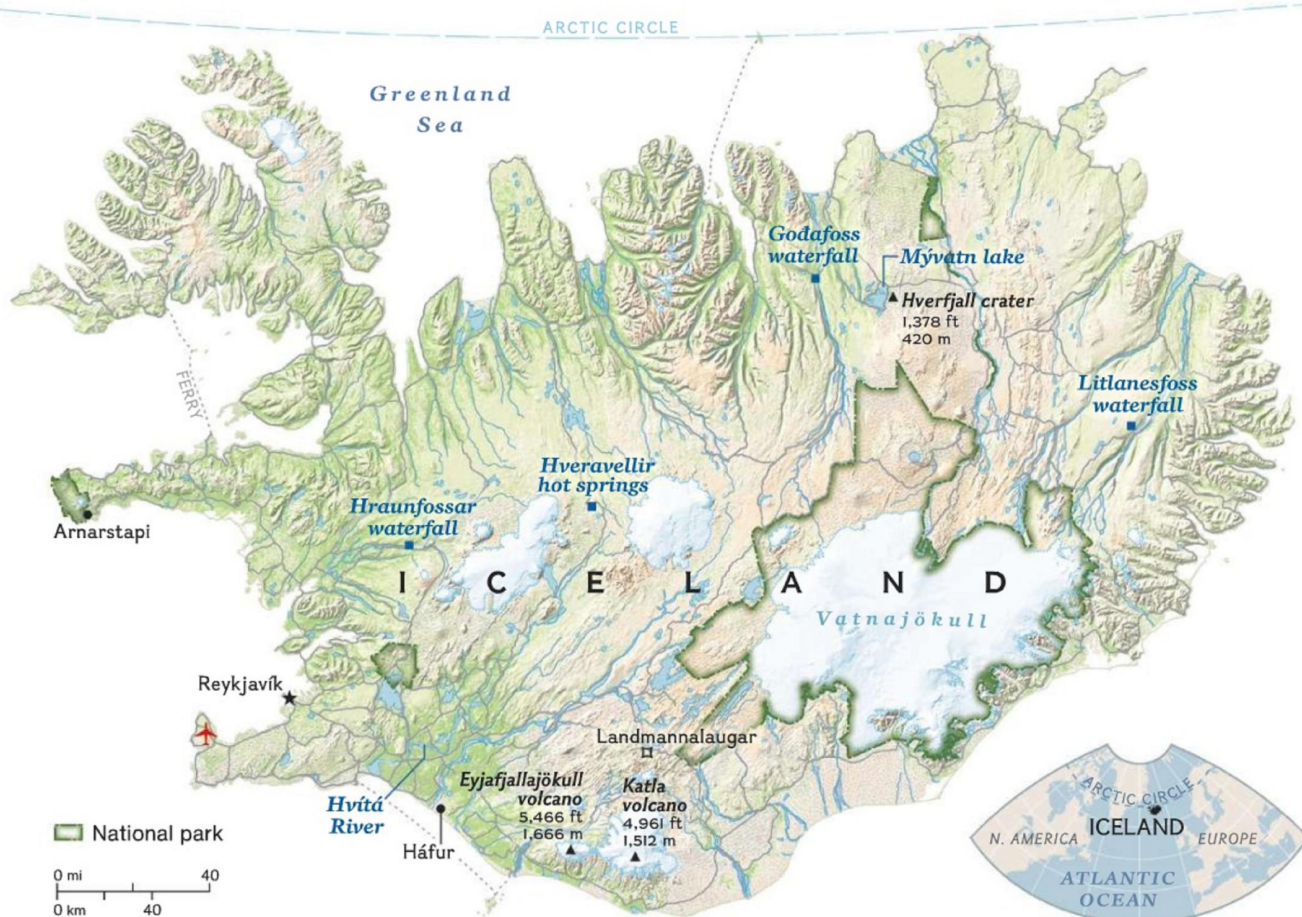
WILD WONDERS OF EUROPE



BY ROBERT KUNZIG

PHOTOGRAPHS BY ORSOLYA AND ERLEND HAARBERG

It was five days before Christmas, and in the hut on the north flank of Eyjafjallajökull, the volcano that grounded airplanes all over Europe in 2010, Sigurður Reynir Gíslason was dishing up fish soup and pickled herring. Lunch felt like a gift. The volcano was quiet, its glacier muffled in clouds, but we'd forded icy river channels to get here, and twice Siggí's SUV had got stuck. Outside the warm hut, gnarly birch trees formed a spiderweb of branches against the white hillside. "This is what it looked like when the Vikings arrived," said Guðrún, Siggí's sister. As we arrived, a ptarmigan fluttered out of the snow. ♦ Guðrún is a geographer, Siggí a geochemist at the university in Reykjavík. They were telling me the story of Iceland's landscape, and if you counted the smoked lamb, all four main actors were present.



VOLCANOES They've built Iceland and kept it above the Atlantic waves for at least 16 million years, and every few years now one of them pops off. In 2010, with aviation authorities frantic about the ash billowing from Eyjafjallajökull, Siggi raced his SUV into the dark heart of the cloud. When he got out to collect some ash, expecting to hear it hailing on his helmet, the silence stunned him. "It was just like flour," he says. But sharp as glass.

GLACIERS They started coming and going around three million years ago, even before the global ice ages began. These days they're shrinking fast but still cover the tallest volcanoes. When a *fall* erupts under a *jökull*, it produces a *jökulhlaup*—a torrent of meltwater and ice that races to the sea, knocking out bridges and flooding farm fields, which soon thereafter may be buried in ash.

PEOPLE The story goes that the first settlers arrived from Norway in A.D. 874—just three years after a pair of massive volcanic eruptions. Guðrún finds those ash layers in soils all the time, and nearly all human artifacts lie higher up. Before 871 Iceland, which is about the size of Kentucky, was essentially empty. The only land mammals were arctic foxes. Between eruptions it was pretty quiet, except for the wind, the sea, and the screech of seabirds.

The Icelanders infused this empty land with meaning—nearly every place seems linked to the ancient sagas somehow—but they also denuded it. Birch forests once filled lowlands and valleys, covering at least a quarter of the country; now it's one percent. Trees were felled for charcoal until the 19th century.

SHEEP Settlers brought cattle and pigs too, but then the climate turned colder for 500 years, and long-haired sheep became the mainstay. In summer hundreds of thousands still graze on open range in the highlands. Being sheep, they eat everything—including birch seedlings. Less than half of Iceland has any vegetation at all, says Guðrún. It used to be two-thirds. As fluffy volcanic soils were exposed, wind and water carried them off by the megaton.

To summarize: Humans and their beasts, struggling to survive in a land of volcanoes and glaciers, have degraded it to an astonishing degree.

If you don't know that story, you see the astonishing beauty that remains.

On December 21, after the sun rose around 11, Siggi, Guðrún, and I tried to press east to another volcano, Katla, whose *jökulhlaup* in 1918 had nearly carried off their grandfather while he was bringing home the sheep. Snow on the coast road forced us back. At Eyjafjallajökull we passed a waterfall that still flowed gray with ash. The wind nearly blew the SUV off the road. Then, as we crossed the glacial river we'd forded the day before, a gap formed in the clouds over the ocean to the south. The hills north of the river were suffused with soft light.

Gunnar, the archetypal saga hero, lived in those hills, Siggi said. Minutes later we passed the mound where Gunnar, heading into exile after one killing too many, was thrown by his horse. Looking homeward, he uttered lines all Icelanders know, and Siggi rendered roughly: "Fair is the hillside, fairer than it has ever seemed. I will go home and not go abroad at all." Iceland still exerts such pull. "Furthermore," note Orsolya and Erlend Haarberg, who came from Norway to take these photos, "there are no trees to block the fantastic views." □

Orsolya and Erlend Haarberg roamed Iceland for ten months in their camper. Robert Kunzig learned to say the volcano's name: AY-ya-fyadd-la-yo-kuddl.





When Hverfjall erupted 2,500 years ago, no one saw it—no one lived in Iceland. On a March evening photographer Orsolya Haarberg watched alone as a north wind scoured Mývatn lake's thin ice, sweeping snow into a drift that looked like a path to the crater.





The first beams of a June day spotlight a ridge of rusty volcanic rhyolite at Landmannalaugar, a hikers' favorite. The Haarbergs hiked up to an overlook after midnight; at dawn, around 3 a.m., the clouds gave them a tiny break. "Five minutes and it was over," says Orsolya.

WILD WONDERS OF EUROPE

At Hveravellir—literally “hot springs in the plain”—thin terraces of geyserate precipitate from the water as it cools. A notorious 18th-century outlaw, Fjalla-Eyvindur, stayed warm here for years, stealing sheep from summer pastures.

Following pages: Hraunfossar waterfall in September looks much as it would have in Viking days: birch trees, bog bilberries, and the Hvítá River, white with silt. The waterfall is a series of springs that plunge into the river on the far bank.













Winter surf pours through arches it has carved in the basalt at Arnarstapi, on the Snæfellsnes Peninsula. In a few months the place will be a carnival of kittiwakes, seabirds that breed here. The large arch is roughly 40 feet high.





A glacial torrent pours over a 40-foot-high ledge at Goðafoss, “waterfall of the gods.” After the Icelandic assembly adopted Christianity in 1000, its leader threw his pagan idols into the falls. The mossy island, notes geographer Guðrún Gísladóttir, “is protected from sheep.”





KOALAS
ARE
UNDER
SIEGE.
CAN
AUSTRALIA
RESCUE
THEM?

SURROUNDED

Two joeys cling to each other at an animal hospital before being placed with human caregivers. Later on, they'll be released into the wild.



Up a tree in Petrie, a town north of Brisbane, a female koala watches photo assistant Jess Hooper approach with a basket to drop on her if she comes down before rescuers arrive. Koalas often return to trees they consider their territory, says rescuer Megan Aitken, "even if those trees are now in somebody's front yard."



IT'S TWO IN THE MORNING AND A KOALA IS CAUGHT IN BARBED WIRE ON A FENCE, LIKE A PRISONER TRYING TO ESCAPE.

A phone rings in the home of Megan Aitken in Burpengary, a suburb north of Brisbane. Aitken, 42, runs a volunteer organization devoted to rescuing wild koalas from a surprisingly wide array of hazards. Before the dispatcher has even given her the location, she has thrown her clothes on over her pajamas.

When Aitken arrives on the scene, Jane Davies and Sandra Peachey, two other volunteers, are already there. The koala is clinging to a chain-link fence, its fur snagged in horizontal strands of barbed wire. Towering eucalyptus trees, as pale as ghosts, rise on the far side of the fence.

"He was obviously trying to get to the trees on the other side," Aitken says.

Standing in the bright cones of car headlights, Aitken pulls on heavy leather welding gloves. Despite their huggable, stuffed-animal appearance, koalas can be ferocious when resisting capture. They'll growl, flail, fight, and bite like angry raccoons, and Aitken has the scars to prove it. Next she places a wire cage on the ground near the animal and opens up a thick blanket. Then the three rescuers rapidly get to work.

Davies throws the blanket over the animal, both to calm it and to protect the rescuers from its teeth and claws. Peachey opens the lid of the cage, while Aitken firmly grasps the little black-nosed beast through the blanket, frees it from the fence, and drops it snarling and snapping into the cage.

Mark Jenkins is a contributing writer. Photographer Joel Sartore authored the National Geographic book Rare: Portraits of America's Endangered Species.

"Well done, ladies!" Aitken shouts.

Looking down at the round-eyed koala they've just captured, Aitken considers a new problem. If this koala were sick or injured, they'd take it to the Australia Zoo Wildlife Hospital, 40 minutes north in Beerwah. But the animal is healthy. By protocol they must release it somewhere nearby, since koalas have a home range and feed in the same trees over and over. Yet this is Deception Bay, a densely populated suburb. The women study a street map with flashlights.

"This is the whole problem," Aitken says, exasperated. "There are so few places left for the koala." In the end they take the animal several blocks to tiny Boama Park, which borders a stretch of open land reaching all the way to the beach. Deep in the night the women carry the cage through the trees, setting it below a gray-skinned eucalyptus. Standing back, they spring the lid of the cage, and the koala dashes up the trunk and disappears.

"Good luck, little one," Aitken says.

It will take a lot more than luck.

The koala, cuddly symbol of a nation and one of the most beloved animals on the planet, is in crisis. Before Europeans settled Australia more than two centuries ago, about ten million koalas lived in a 1,500-mile-long swath of the east coast eucalyptus forests. Hunted for their luxurious fur, koalas were brought to the edge of extinction in the southern half of their range. In the northern half, Queensland, a million were killed in 1919 alone. After the last open season in Queensland was held in 1927, only tens of thousands remained.

Through the next half century their numbers slowly rebounded, in part due to efforts to relocate and recolonize them. Then urbanization began to take its toll. Habitat was lost, and diseases spread. With urbanization came the threat of dogs and highways. Since 1990, when about 430,000 koalas inhabited Australia, their numbers have dropped sharply. Because surveys are difficult, current population estimates vary widely—from a low of 44,000 by advocacy groups to a high of 300,000 by government agencies. More



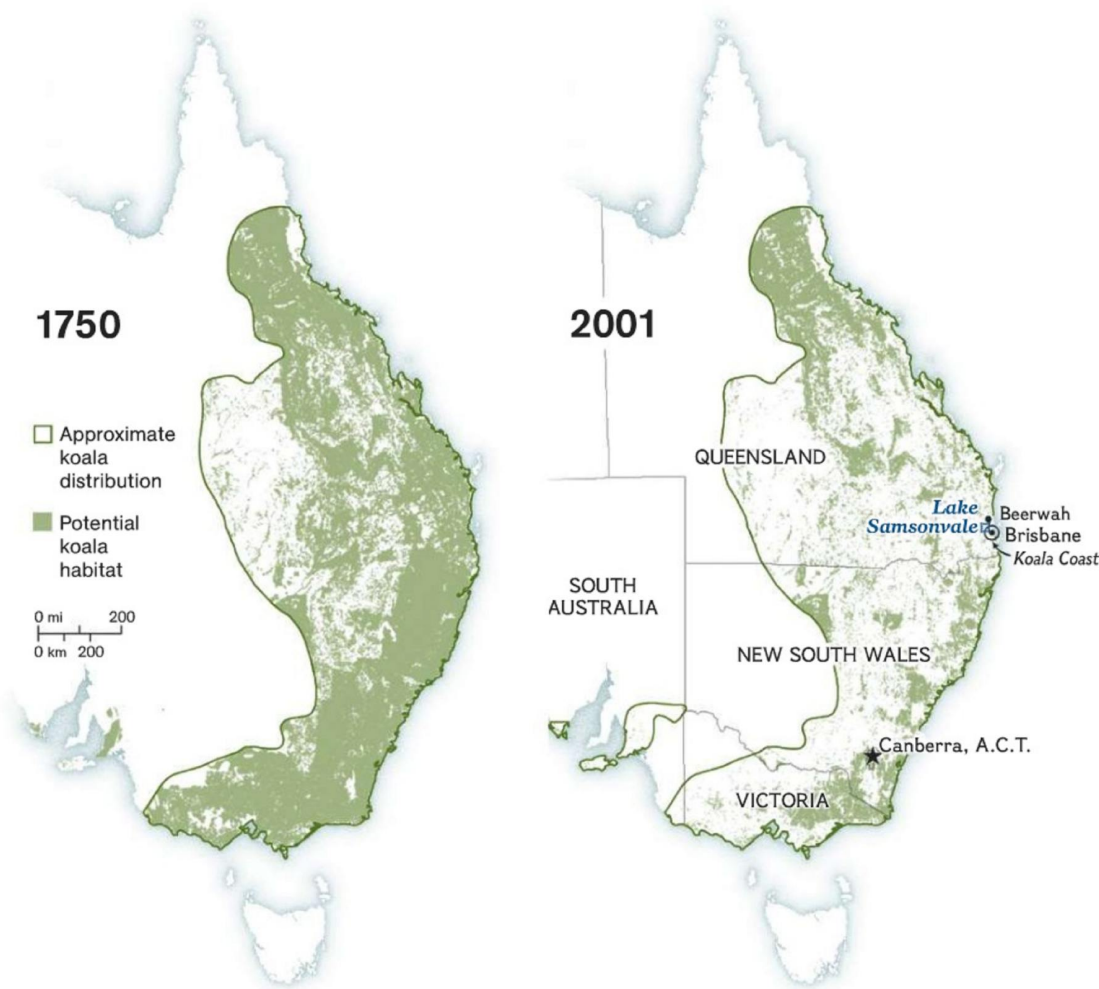
than a decade ago a survey of the Koala Coast, a 93,000-acre region in southeastern Queensland, estimated a koala population of 6,200; today there are believed to be around 2,000.

“Koalas are getting caught in fences and dying, being killed by dogs, struck by vehicles, even dying simply because a homeowner cut down several eucalyptus trees in his backyard,” says Deidré de Villiers, one of the chief koala researchers at the Queensland Department of Environment and Resource Management. For 15 years de Villiers, 38, has been tracking koalas, monitoring populations, studying the reasons for their decline, and creating guidelines to make development more koala-friendly.

De Villiers insists that koalas and humans can

With no place to hide, koalas are being squeezed out of Queensland communities like North Lakes that 20 years ago were farmland and wildlife habitat. Hunted ruthlessly in the early 20th century, koalas were later protected and made a modest recovery. Today their numbers are again in steep decline.

coexist in urban environments “if developers get on board with koala-sensitive designs,” such as lower speed limits for streets, green corridors for koala movement, and, most especially, preserving every precious eucalyptus tree. Unfortunately, koalas have another problem.



LOSING THEIR EUCALYPTUS TREES

Before Europeans settled Australia, some ten million koalas thrived along the east coast in eucalyptus and *Callitris* stands. Nearly two-thirds of these forests have since been removed. Although population estimates are incomplete and controversial, koala numbers are in decline and may well total fewer than 100,000.



“Disease is the other huge issue,” says veterinarian Jon Hanger, 42, from the Royal Society for the Prevention of Cruelty to Animals in Queensland. Hanger has discovered that as much as half of Queensland’s koala population may be affected by the sexually transmitted disease chlamydiosis. In some wild koala populations more than 50 percent of the sexually mature females are infertile. The genesis of the disease is unknown, but it manifests itself as urogenital and ocular disease and is transmitted through mating and birthing, as well as fighting among males. Unlike in humans, chlamydiosis in koalas is often fatal.

“Koala populations that used to be vibrant and sustainable are becoming extinct,” says Hanger,

who puts the blame squarely on the provincial government. “Queensland has failed miserably to do anything meaningful about the decline. The federal government needs to get involved and do it properly, listing the koala as vulnerable to extinction.” Such a designation might save the last remnants of critical koala habitat, he argues. Hanger is also part of a research team developing a chlamydia vaccine.

A recent report presented to the Australian Senate made several recommendations to save the koalas, including listing the animals as threatened and vulnerable, funding a program to monitor koala populations, mapping their habitat, and managing federal and private lands to protect the koalas. Until such measures are



taken, the efforts of grassroots koala emergency squads will continue to be essential.

“The more koalas we lose, the more valuable each rescued koala becomes,” says Hanger.

Deidré de Villiers takes the koalas’ plight personally. Visitors to her home in Loganholme, south of Brisbane, discover that the woman who is a respected koala researcher by day is a doting koala foster parent by night.

“Ruby still sleeps in the basket hugging her teddy bear,” she says. The baby koala is cocooned in a cane picnic basket like an infant in a bassinet. “She was rescued from the jaws of a dog. You want to hold her?”

De Villiers picks up Ruby and hands her to

Koala crusader Ray Chambers of the Sunshine Coast Koala Wildlife Rescue nets a female and her joey as Phil Siggers looks on. The adult had conjunctivitis, common in koalas. “You’ve got to be gentle with them,” says Chambers, an auto repairman who co-founded the southeast Queensland organization.

me, the koala’s needle-sharp claws piercing my neck and face. I wince, and de Villiers, whose arms are crosshatched with scratches, laughs.

“She likes to have both hands and feet gripping something when she’s picked up,” she says. My lip is bleeding, so I hand the little beast back.

Locked up—temporarily—by koala rescuers in Joyner, this male will be safer after he gets a checkup, an ear tag and microchip, and a trip to a park or other locale. Hundreds of koalas are killed or injured every year on roads.







**“THE MORE KOALAS WE LOSE,
THE MORE VALUABLE EACH RESCUED
KOALA BECOMES.”** VETERINARIAN JON HANGER

De Villiers gently places Ruby onto a tree limb in her playpen in the dining room. Her playmate, Luna, another orphaned koala, is asleep in the crook of the branch. Through the glass doors of the dining room, out on the patio, a larger playpen is visible, and in the backyard stands a chain-link enclosure filled with trees.

De Villiers is caring for five koalas at once: Ruby, Luna, Tia, Mr. T, and Munchie. Ruby is quiet, Luna is ticklish, Tia likes to jump, Mr. T is mischievous, and Munchie is aloof. Every other day de Villiers cuts and collects eucalyptus leaves, the koalas' primary food, from a nearby plantation. During the past 12 years, she's fostered more than 60 animals.

“Ruby has to go to the hospital tomorrow,”

she says. “She has a respiratory tract infection that's not improving.”

The next day she takes Ruby to the Australia Zoo Wildlife Hospital, a state-of-the-art facility that was built by Steve Irwin, the TV naturalist who died in 2006. Ruby is admitted, sedated, then anesthetized and intubated to feed oxygen and drugs to her lungs. Everything is efficient, orderly, and hyperclean.

“She has a nasty case of pneumonia,” says Amber Gillett, 30, a vet who has worked here for six years. “It can be fatal, particularly for young koalas.”

While de Villiers strokes the still-unconscious Ruby, Gillett flushes the koala's lungs with a saline solution and takes a sample that is whisked



to the lab for culturing. "I'd guess we have about a 70 percent success rate with pneumonia in koala joeys," she says, as Ruby is wheeled off to the x-ray room. "I think this little one will make it."

The following afternoon Ruby's back home, recuperating in a playpen with Luna.

One morning not long after, de Villiers sets out into the scrubby forest near Lake Samsonvale, northwest of Brisbane, to catch Tee Vee, a wild koala the researcher has been monitoring for more than a year. The Department of Environment and Resource Management has relocated several koalas into Tee Vee's territory, and de Villiers has been recording the impact on the local koala

Despite four hours of surgery, Robyn Stenner (above) of the Australia Zoo Wildlife Hospital was unable to save Lauren, a female whose abdomen was crushed by dogs. "It's a common injury," says Stenner. "But it always breaks your heart." Lucky to be alive, Harley (left) is on the mend after being hit by a car.

population. Using a receiver that resembles an old-fashioned rooftop TV antenna, she walks through second-growth bush, listening for a signal from the koala's radio collar.

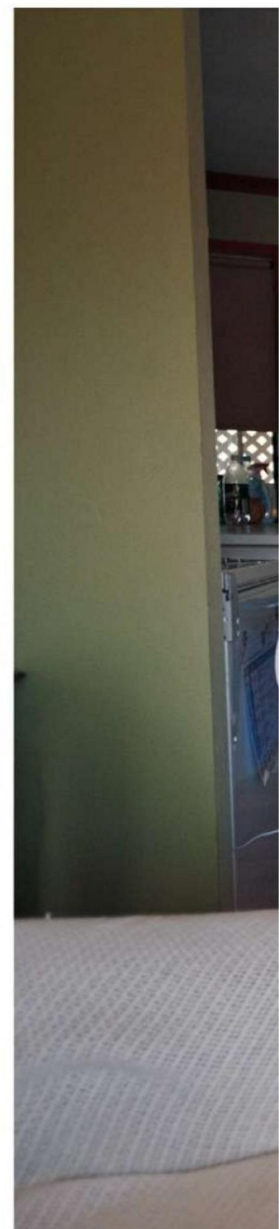
She eventually picks up a faint signal and follows it over hill and dale as the beeping, like a





Killed in a single week by cars or dogs, these koalas were mourned at the vet clinic that tried to save them. During “trauma season,” from July to December, when the animals descend to the ground in search of mates and new food trees, a dozen or so injured koalas a week are brought to the clinic.

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“A KOALA’S NATURAL BEHAVIOR IS TO HUG ITS MOTHER OR HUMAN CAREGIVER. THERE’S NOTHING LIKE THEM.” BIOLOGIST DEIDRÉ DE VILLIERS

koala Geiger counter, grows louder and louder.

“I see her!” she says finally. A basketball-size gray lump is clinging to a branch of an ironbark tree 50 feet or so directly above.

Capturing a koala high in the canopy is complicated. First a giant slingshot blasts a ball of string over a tree limb close to the koala. This may require several tries. The string is attached to a climbing rope, which is pulled up over the limb and tied off taut to the ground. A 30-foot ladder is then set against the tree. Someone must scale the ladder and inch up the rope, carrying a “flagging pole” like a trapeze artist.

That someone is de Villiers, of course. Rigged out like a rock climber, she scrambles up the tree, agile as a koala herself. Dangling from a

limb, she attempts to “flag” the koala, by flapping a flag of plastic or fabric attached to the end of the pole above its head. This annoys koalas, and Tee Vee starts shimmying backward down the trunk.

But Tee Vee, as de Villiers says, “is an obstreperous handful.” Halfway down the tree, the koala runs out on a limb and cleverly jumps into another tree, starting the whole process over again.

The second time Tee Vee backs down, she gets within 20 feet of the ground before freaking out, leaping into midair like a flying squirrel. But koalas are round and don’t fly. Tee Vee lands on the ground and is quickly captured with a blanket, screeching and clawing and biting like a little wolverine.



After Tee Vee is sedated, de Villiers gets to work. Using a variety of instruments, she measures everything from the length of the koala's body to the width of her skull, the size and wear of her teeth to the silkiness of her fur. Weight and general health are also noted.

"I think she has a baby," de Villiers says suddenly.

And with that, she slips her finger into the downward-facing pouch, opens it up, and delicately draws out a four-inch-long, blind, furless, alien-looking creature with fully developed razor-sharp claws.

A deep, spontaneous "ahhh" escapes from everyone present, even the rangers who have done this many times before.

Volunteer David Wistrom of Narangba dons a koala suit at events to raise public awareness. "Aussies love koalas," he says, "but most have no idea how threatened they are." Caregiver Anika Lehmann (left) says that Talisa, a rescued female, will eventually be returned to the wild.

De Villiers deftly examines the infant and pouch for any signs of disease or abnormality, then softly pushes the joey back inside the sleeping mother.

"While there are still healthy babies, there's still hope," she whispers. □

*Playing mom to an armful of koalas
“doesn’t allow me much time for
anything else,” says Samantha
Longman of Ormiston, who’s been
raising orphans for five years. “But
the little guys are part of our family.
What we’re doing is important.”*







King Tut in Seattle

EXHIBIT

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LECTURE



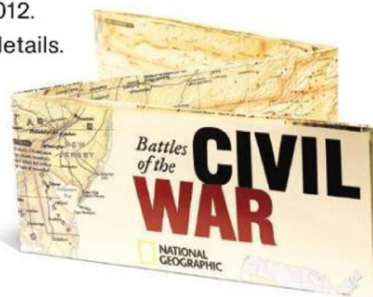
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Free Download of the Month



Brownout Oozy

Brownout is the musical alter ego of Grammy-winning powerhouse Grupo Fantasma. But where Grupo Fantasma explores contemporary Latin sounds, Brownout harks back to the heyday of Latin funk and soul, updating the sounds of classic acts like Santana for the 21st century. Download a song from the album at natgeomusic.net/free.

Body Count Staff from an animal care center in Queensland, Australia, helped photographer Joel Sartore make this array of a single week's koala losses. Some of the dead, like the mother and baby in the bottom row, were attacked by dogs. Others were struck by cars. A few, like those shown brightly bandaged, arrived alive and received treatment for their injuries but still did not survive. —Margaret G. Zackowitz



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BEHIND THE LENS

How—and why—did you take this photograph?

JS: I knew I had to get a picture of dead koalas for this story, but I kept running into trouble. People at the animal clinic I was working with said it would look bad. The Australian government doesn't even like to acknowledge that these koalas are endangered. But the staff at one place I visited thought this was an important picture to make. They told me that in this area these

animals will be gone entirely in another three to five years. They want the world to know that. So instead of disposing of the bodies as the dead koalas arrived during the week, the staff members saved them for me back in a freezer room at the facility.

One of the workers smuggled them out for me to photograph, and when we were done, we went back and replaced them in the freezer.

How did that make you feel?

Talk about a sinking feeling. Even though

I'd never seen these particular koalas alive, I kind of felt like I'd gotten to know them. Putting them all back in a bin in the freezer room was hard. The one that really got me was the mother with the baby still in her arms.



Hot Stuff Bathers bask in geothermal mud at a spa in Iceland in the early 1950s. The treatment is said to relax the muscles and soothe the skin. Present-day spas in the country continue the tradition, limiting sessions in the 100°F mud to 15 minutes and warning off those with heart or lung problems or allergies to nickel.

Writer Deena Clark covered the country in her story “Iceland Tapestry” for the November 1951 *Geographic*. She made no mention of mud baths but did share the packing list an official gave her prior to her trip: “You’ll need a passport, a cocktail dress, a dinner gown, a raincoat, galoshes—and a boundless capacity for astonishment! ... I found he was right,” she noted, “especially about the last.” —Margaret G. Zackowitz

👉 **Flashback Archive** Find all the photos at ngm.com.

PHOTO: AMSTERDAM PRESS AGENCY/NATIONAL GEOGRAPHIC STOCK

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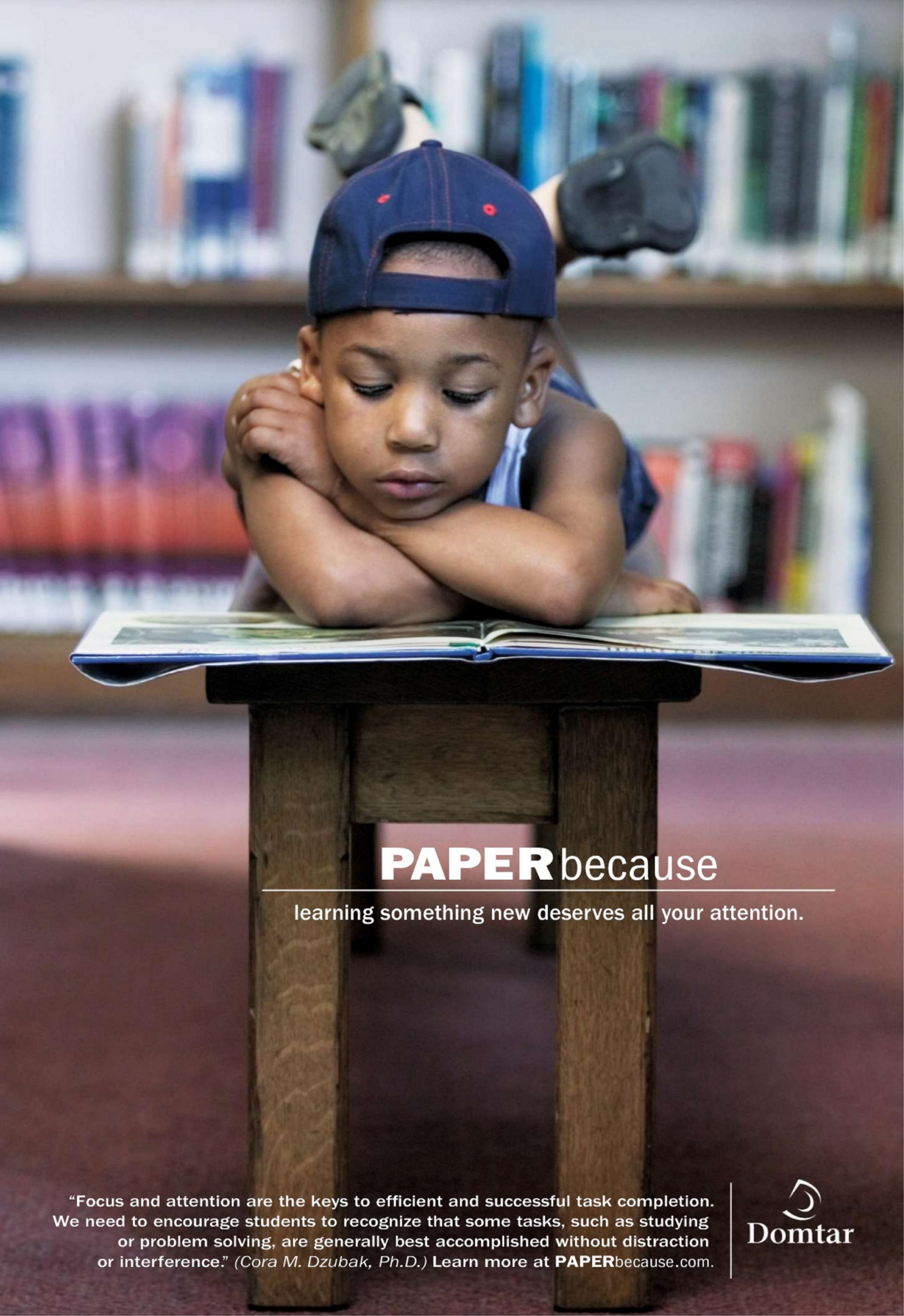
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